4 ENVIRONMENTAL IMPACTS AND MITIGATION MEASURES

4.1 Introduction

As discussed in this Supplemental Environmental Impact Statement (SEIS) Sections 2 and 3, the Generic Environmental Impact Statement (GEIS) evaluated the potential environmental impacts of in situ recovery (ISR) projects in four distinct geographic regions, including the Nebraska-South Dakota-Wyoming Uranium Milling Region (NSDWUMR), where the proposed Ross Project area is located. Four project phases were evaluated in the GEIS for each of the geographic regions (i.e., construction, operation, aquifer restoration, and decommissioning). The activities that would occur during the four project phases at the Ross Project and their timeframes are described in SEIS Section 2. Because of the similarities between the ISR projects examined in the GEIS and the proposed Ross Project, many of the conclusions found in the GEIS can be used to identify and rate the relative impacts of the Proposed Action in this SEIS. However, if the results of the GEIS's impact analyses indicated a wide range of impacts on a particular resource area (e.g., from SMALL to LARGE), then that resource area was evaluated in greater detail within this site-specific SEIS.

The information that has been used to perform these site-specific impact analyses has been obtained from the license-application documents submitted by the Applicant to the U.S. Nuclear Regulatory Commission (NRC) in 2011 as well as subsequent information provided by the Applicant in 2012 (Strata, 2011a; Strata, 2011b; Strata, 2012a; Strata, 2012b). The NRC staff has compiled related information from publicly available sources as well (see SEIS Section 2.1). All of this information has allowed the NRC to perform site-specific assessments of the environmental impacts of the proposed Ross Project facility and wellfields, as needed, and to evaluate the measures that would successfully mitigate those impacts.

NRC established a standard of significance for its analyses of environmental impacts during the conduct of its environmental reviews, as described in the NRC guidance NUREG–1748 (NRC, 2003). This standard is summarized as follows:

SMALL: The environmental effects are not detectable or are so minor that they will neither destabilize nor noticeably alter any important attribute of the resource considered.

MODERATE: The environmental effects are sufficient to alter noticeably, but not destabilize, important attributes of the resource considered.

LARGE: The environmental effects are clearly noticeable and are sufficient to destabilize important attributes of the resource considered.

This section of the SEIS analyzes the four lifecycle phases (i.e., construction, operation, aquifer restoration, and decommissioning) of the proposed Ross Project, consistent with the analytical approach used in the GEIS (NRC, 2009). This assessment is conducted for the Proposed Action and the two Alternatives (the No-Action and North Ross Project Alternatives). The impacts are organized by the environmental resource and management areas commonly examined for the satisfaction of the *National Environmental Policy Act* (NEPA) requirements. These areas include:

- Land Use
- Transportation
- Geology and Soils
- Water Resources (Surface and Groundwaters)
- Ecology
- Air Quality
- Noise
- Historical, Cultural, and Paleontological Resources
- Visual and Scenic Resources
- Socioeconomics
- Environmental Justice
- Public and Occupational Health and Safety (Nonradiological and Radiological)
- Waste Management

The respective mitigation measures that would moderate the identified environmental impacts are also discussed in this section for each resource and management area. Many types of mitigation measures can be considered when any particular resource or management area's impacts are evaluated. Some of the mitigation measures that are described in this section of the SEIS include:

- Permit and License Requirements
- Regulatory Requirements and Standards
- Facility Design Criteria and Modifications
- Process and System Adjustments
- Engineering and Management Techniques
- Best Management Practices (BMPs)
- Standard Operating Procedures (SOPs)
- Management and Operating Plans
- Training Prerequisites
- Scheduling and Phasing Variations

The respective environmental impacts and associated mitigation measures identified and evaluated in this section are also summarized in Section 8, Summary of Environmental Impacts and Mitigation Measures, in Table 8.1.

4.2 Land-Use Impacts

The Proposed Action could impact local land use during all phases of the Project's lifecycle. Potential land-use impacts could result from land disturbance during, especially, the Ross Project's construction and decommissioning; from grazing and access restrictions; and from competing access for mineral rights. These potential impacts could be greater in the areas where there are higher percentages of private landownership. As shown in Table 2.1, the surface owners of the Ross Project area include private owners (553 ha [1,367 ac]), the State of Wyoming (127 ha [314 ac]), and the U.S. Bureau of Land Management (BLM) (16 ha [40 ac]). At the end of operation, final site reclamation would occur during decommissioning, and all lands would be returned to their current land use. These current land uses include livestock grazing, crop agriculture, and wildlife habitat. Detailed discussion of the potential environmental impacts to land use during construction, operation, aquifer restoration, and decommissioning and site restoration for the proposed Ross Project are provided in the following sections.

4.2.1 Alternative 1: Proposed Action

Alternative 1 consists of four phases: construction, operation, aquifer restoration, and decommissioning of an ISR uranium-recovery facility and wellfields.

4.2.1.1 Ross Project Construction

The GEIS identified potential land-use impacts during construction resulting from land disturbances and site-access restrictions that could limit other grazing, mineral extraction, or recreational activities (NRC, 2009). As discussed in GEIS Section 4.4.1, potential impacts to most aspects of land use from the construction of an ISR facility would be SMALL (NRC, 2009). This is because the amount of area disturbed by the construction would be small in comparison to the available lands; the majority of the site would not be fenced; potential conflicts over mineral access would be expected to be negotiated and agreed upon; only a small portion of the available land would be restricted from grazing; and the open spaces for hunting and off-road vehicle access would be minimally impacted by the fencing associated with the ISR facility. The GEIS defined land-use impacts to be SMALL when they ranged from 50 – 750 ha [120 – 1,880 ac] (NRC, 2009).

What are mineral rights, oil rights, and drilling rights?

Rights may be conferred to remove minerals, oil, or sometimes water that may be present on and under some land. In jurisdictions supporting such rights, they may be separate from other rights to the land. The rights to develop minerals, and the purchase and sale of those rights, are contractual matters that must be agreed between the parties involved.

Construction-phase activities during the Proposed Action would include construction of buildings, other auxiliary structures, and surface impoundments; wells, wellfields, and pipelines; and transportation and utility infrastructure (e.g., roads and lighting). The Applicant estimates that construction activities would disturb a total of 113 ha [280 ac] of land, which represents 16 percent of the Ross Project area. The impacts on specific areas of the Proposed Action by construction activities are summarized in Table 4.1.

Table 4.1
Summary of Land Disturbance during Construction of Proposed Action

Activity	Total Area Impacted by Proposed Action (ha [ac])	Total Area Impacted in the Year Preceding Proposed Action Operation (ha [ac])	Primary Current Use
Central Processing Plant	22 [55]	22 [55]	Dryland crop production Pasture
Wellfield Modules	65 [160]	14 [85]	Livestock grazing Oil and gas production
Access Roads	12 [30]	5 [12]	Livestock grazing
Deep-Injection Wells	2 [5]	1 [3]	Livestock grazing
Pipelines	6 [15]	2 [5]	Various
Utilities	6 [15]	2 [5]	Various
TOTAL	~ 113 [280]	~ 47 [116]	

Source: Strata, 2011a.

The Applicant would mitigate short-term impacts resulting from construction activities by phasing its activities and limiting the amount of land disturbance at any one time; promptly restoring and reseeding disturbed areas; coordinating efforts with the oil-production company currently operating within the Ross Project area (i.e., Merit Oil Company [Merit]); using existing roads wherever possible; following existing topography during access-road construction to minimize the need to cut and fill; minimizing secondary and tertiary access-road widths; and locating access roads, pipelines, and utilities in common corridors. In addition, the Applicant would establish surface-use agreements with surface owners/lessees to mitigate and/or to compensate for their temporary loss of use in areas which are currently used for livestock grazing or crop production. Cultivated fields would be specifically avoided, where possible, during facility construction and wellfield installation.

As shown in Table 2.1, of the 16 ha [40 ac] of BLM surface-administered land within the Ross Project area, 0.5 ha [1.3 ac] would be disturbed by the Proposed Action. This disturbance would take place during the construction phase. The Applicant would restrict hunting during the life of the Project in order to protect workers. Hunting and recreation are not major land use activities within the Ross Project area and there is no public access to BLM lands, therefore impacts would be minimal.

All of the construction activities at the Ross Project would result in temporary, short-term impacts, with the current use restored following construction, except for the area where the central processing plant (CPP) and surface impoundments (i.e., the facility) would be constructed. The use of the Ross Project lands, however, would be restored after all uranium-recovery activities have ceased. The area of surface disturbance the Applicant estimates for the Proposed Action is less than that identified in the GEIS, and no site-specific impacts have been identified for the Proposed Action that would change the magnitude of the impacts identified by the GEIS (NRC, 2009). Thus, the land-use impacts resulting from the Ross Project would be SMALL.

4.2.1.2 Ross Project Operation

The primary land-use impact during the Ross Project's operation would be due to the Applicant's installing additional wellfields and its operating the processes and circuits located in the CPP; however, these impacts are generally the same as those addressed in the construction-phase analysis above. Additionally, the affected area would be reclaimed over the longer term.

As during the construction phase, the Applicant would reduce ongoing impacts to livestock grazing by fencing less than 12 percent of the Ross Project area at any one time, including the CPP and wellfields, during active operation of the Ross Project. In addition, the Applicant would continue to work with Merit, as discussed above, so as not to impact its oil-recovery operation.

No further land-use impacts have been identified for the Ross Project beyond those identified in the GEIS. Thus, the land-use impacts resulting from the operation of the Proposed Action would be SMALL.

4.2.1.3 Ross Project Aquifer Restoration

Land use impacts during aquifer restoration would be similar to those during construction, as they could involve temporary access restrictions, and are expected to be SMALL according to GEIS Section 4.4.1 (NRC, 2009). The impacts to land use during the Proposed Action's aquifer-restoration phase would be similar to those during the construction and operation phases, and they are consistent with the GEIS. These impacts could involve temporary access restrictions, but they are expected to be few. Mitigation measures during the Proposed Action's aquifer-restoration phase would be identical to those identified for its construction and operation. Therefore, the land-use impacts resulting from aquifer-restoration activities at the Ross Project would be SMALL.

4.2.1.4 Ross Project Decommissioning

As discussed in GEIS Section 4.4.1, land-use impacts would temporarily increase during decommissioning and related site restoration of an ISR facility due to the additional equipment that would be used for dismantling and removal of wellfields, pipelines, and other wellfield components as well as the demolition of the processing plant itself and any surface impoundments. In addition, the reclamation of the site would involve heavy equipment and significant earth disturbance. However, these short-term impacts would not be greater than those experienced during the construction phase. Therefore, the GEIS concluded that the land-use impacts that result from the decommissioning an ISR facility would be SMALL (NRC, 2009).

During decommissioning, the Ross Project area would be returned to its approximate preconstruction state, including surface topography and drainage patterns. All roads and wellfields would be removed and reclaimed, unless exempted by the request of a landowner. Topsoil would be salvaged and redistributed on disturbed areas to a depth approximately equal to pre-licensing baseline conditions. Additional subsoil would be ripped as needed to minimize soil compaction prior to revegetation. Revegetation would be completed in accordance with an approved restoration plan, which would be required as part of Strata's Permit to Mine, and a seed mix approved by WDEQ/Land Quality Division (LQD) and the landowners would be used. Seeding would be conducted by either drill or broadcast methods, as appropriate. Once vegetation has been re-established (and all radioactive materials have been removed), the Project area would be released for unrestricted use and would no longer require a license from the NRC.

The land-use impacts resulting from the decommissioning of the Proposed Action would be SMALL and the site's restoration would ameliorate all land-use impacts caused by earlier phases of the Proposed Action.

4.2.2 Alternative 2: No Action

Under the No-Action Alternative, the Ross Project would not be licensed and the land would continue to be available for other uses. Although limited construction activities could occur, the 113 ha [280 ac] of land surface potentially disturbed during the Proposed Action would remain mostly undisturbed. No pipelines would be laid and no additional access roads would be constructed. The Applicant could continue with some preconstruction activities, such as abandonment of exploration drillholes and the collection of environmental monitoring data, but these activities would have little land use impact.

The current land uses of natural-resource extraction and livestock grazing would continue with no access restrictions within the Ross Project area. Impacts to current land uses from the continued oil-production activities could also occur from accidental breaks or failures in equipment and infrastructure; however, these impacts are no different than would occur whether or not the Proposed Action were to be licensed, constructed, or operated. There would be no impact from activities associated with construction and operation of the Proposed Action under the No-Action Alternative.

Under the No-Action Alternative, there would also be no impacts due to aquifer-restoration or decommissioning activities at the Ross Project area, because no wells would have been installed nor wellfields developed for uranium recovery. Thus, there would be no impact to the current land uses. There would be no impact to land use from decommissioning activities because the Ross Project would not have been licensed, constructed, or operated. No buildings would require decontamination and dismantling; no topsoil would need to be reclaimed; and no land would need to be revegetated. The land-use impacts of the No-Action Alternative would be SMALL.

4.2.3 Alternative 3: North Ross Project

Under Alternative 3, the North Ross Project would generally be the same as the Proposed Action, except that the facility (i.e., the CPP, associated buildings, and auxiliary structures as well as the surface impoundments) would be located to the north of where it would be located in the Proposed Action, as described in SEIS Section 2.1.3. This north-site facility would be located about 900 m [3,000 ft] northwest of that the Proposed Action. Construction activities would still disturb an approximate total of 113 ha [280 ac] of land, which represents 16 percent of the total Ross Project area. The impacts from each activity would be approximately the same as those summarized in Table 4.1, except that construction of the surface impoundments at the north site could require additional engineering, while the containment barrier wall (CBW) would not need to be constructed.

For Alternative 3, the CPP would not be located in an area of dry-land crop agriculture or pasture. Therefore, Alternative 3 would cause less impact to land use if the CPP and surface impoundments were to be constructed at the north site. Nonetheless, there would be an increased loss of wildlife- and livestock-grazing opportunities during the construction and operation phases of Alternative 3, just as in the Proposed Action; these impacts would result from the construction of access roads and installation of wells, pipelines, and utilities. The total land area disturbed would be essentially the same (approximately 113 ha [280 ac]). During Alternative 3's operation and decommissioning as well as during the restoration of the underlying aquifer, this Alternative's impacts would be the same as those discussed earlier for the Proposed Action, because the area of land-use disturbance would generally be the same. Finally, because the impacts to land use would generally be the same in Alternatives 1 and 3, the mitigation measures for Alternative 3 would be the same, as would be their effectiveness, as those described for Alternative 1. Based upon this analysis, the land-use impacts resulting from Alternative 3 would be SMALL.

4.3 Transportation

The Proposed Action could impact transportation during all phases of the Project's lifecycle. Transportation impacts would result from workers commuting to and from the Ross Project area;

visitors, such as regulatory agency personnel, travelling to and from the Project; from shipments to the Ross Project area of supplies, materials, and chemicals used during the uranium-recovery and milling processes; from shipments of other materials including uranium-loaded ion-exchange (IX) resins from future satellite areas within the Lance District (which are considered in SEIS Section 5, Cumulative Impacts) and/or other offsite ISR or waste-water treatment facilities (i.e., toll milling); and shipments of yellowcake and wastes from the Ross Project area to other, offsite facilities such as a uranium-conversion facility. Transportation impacts could also include increased fugitive dust that would be released during the increased traffic, increased traffic accidents, increased noise, and increased incidental wildlife or livestock mortalities, compared to current area conditions. Fugitive-dust impacts are evaluated as air-quality impacts and public and occupational health impacts in SEIS Sections 4.7 and 4.13, respectively. Noise impacts are evaluated in SEIS Section 4.8. Wildlife and livestock mortalities are evaluated as potential ecological impacts in SEIS Section 4.6. Detailed discussion of the other potential environmental impacts from Project-related transportation to and from the Ross Project area during construction, operation, aquifer restoration, and decommissioning is provided in the sections below.

4.3.1 Alternative 1: Proposed Action

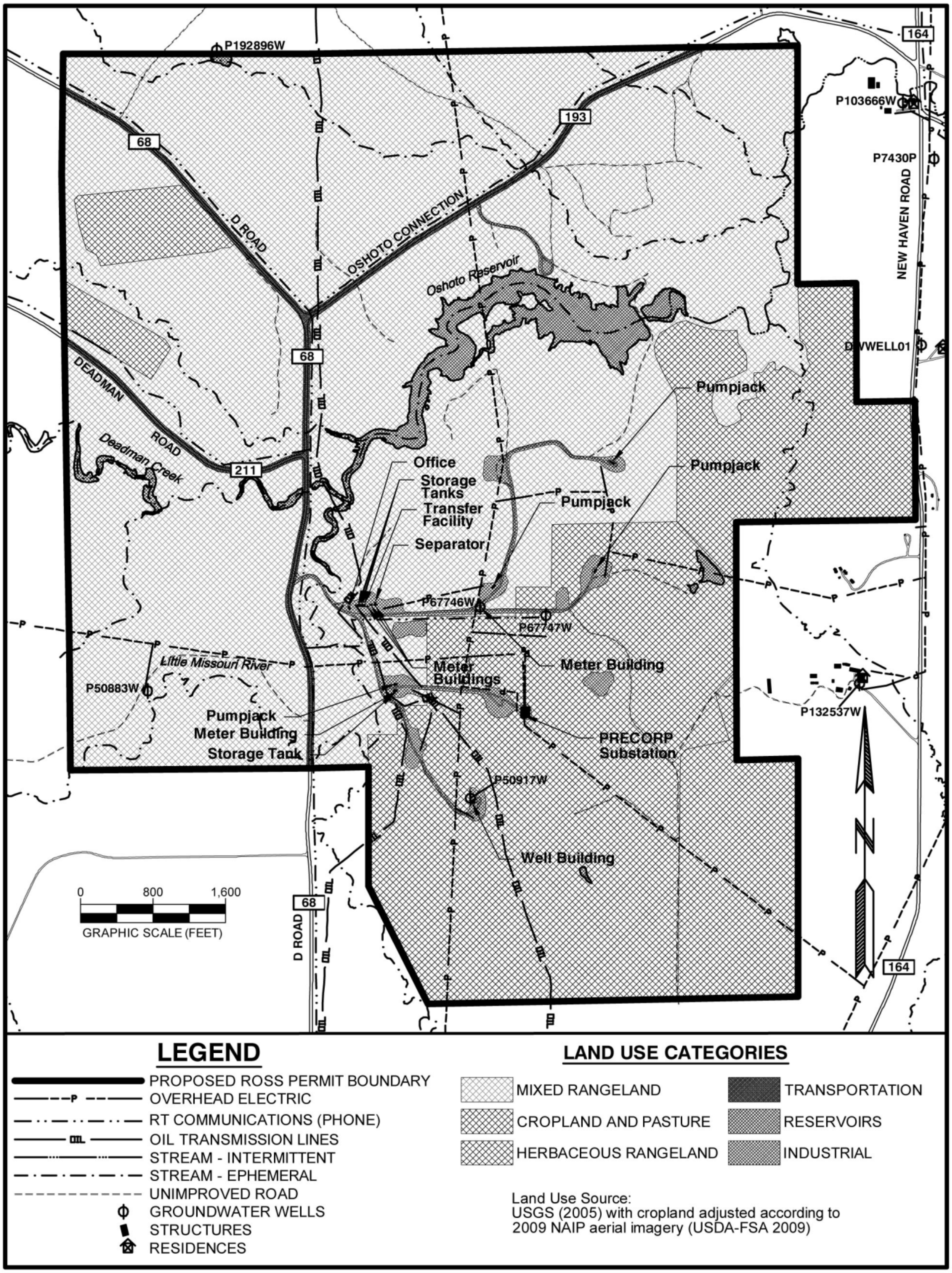
Alternative 1, the Proposed Action, consists of four phases: construction, operation, aquifer restoration, and decommissioning of a uranium-recovery facility and wellfields. During the Proposed Action, transportation impacts for all phases of the Ross Project would result from the increased traffic on roads compared to current (2010) levels (see Figure 4.1); these traffic increases are summarized in Table 4.2.

Table 4.2
Estimated Number of Workers and Traffic Volumes for Ross Project

Project Phase	Average No. Daily Workers	Traffic	
		Passenger Vehicles per Day	Trucks per Day
Construction	200	400	24
Operation	60	120	16
Aquifer Restoration	20	40	12
Decommissioning and Site Restoration	90	180	10

Source: Strata, 2011a.

Note: Vehicle counts are to and from the Ross Project (two one-way trips per vehicle per day) and each assume that each worker would be in a separate passenger vehicle.



Source: Strata, 2012a.

Figure 4.1

Ross Project Design Components to be Decommissioned and Land Uses to be Restored

4.3.1.1 Ross Project Construction

As described in GEIS Section 4.4.2, the increase in daily traffic on most roads that would be used for construction-supply transport and workforce commutes would not be significant and, therefore, traffic-related impacts would be SMALL (NRC, 2009). Roads with the lowest average annual daily traffic volumes, such as local county roads, would have higher (i.e., MODERATE) potential impacts, particularly when the ISR facilities are experiencing peak employment (NRC, 2009). The limited duration of construction activities (i.e., 12 – 18 months), suggests that impacts would be of short duration in many areas where such a facility would be sited.

The highest traffic volumes resulting from the proposed Ross Project would occur during the construction phase of the Proposed Action because of the relatively large workforce (i.e., 200 persons) and the frequent material and equipment shipments. The increased traffic is expected to be 400 passenger cars and 24 trucks per day, which, compared to 2010 levels, represents a traffic increase of approximately 400 percent on the New Haven Road south of the Ross Project area, which would be the workers' primary route to the Project area (Strata, 2011a). This volume is higher than that assumed in the GEIS (NRC, 2009). This significant increase in traffic could result in more traffic accidents as well as wear and tear on the road surfaces. It is expected that additional road-maintenance activities would be needed. Due to the increased projected traffic volumes on the local and county roads between I-90 and the Ross Project area, the construction impacts would be MODERATE to LARGE with respect to the traffic levels and the road-surface wear and tear.

The increase in traffic on I-90 itself would be approximately 10 percent when compared to 2010 volumes. This increase to traffic on the interstate-highway system would be SMALL, and such impacts would mostly be related to increased traffic volume. However, the Interstate-highway system has been built to accommodate additional capacity and, therefore, the resulting impacts, if any, would be minor.

As noted above, traffic impacts to local roads are expected to be greatest during the Proposed Action's construction, and the Applicant identifies the following expected mitigation measures (Strata, 2011a):

- Improve signage, including speed-limit signs, on D and New Haven Roads.
- Implement a policy to enforce speed limits for Strata employees and contractors. The Applicant and Crook County have already executed a Memorandum of Understanding (MOU) that specifies the activities that Strata would undertake to assist with speed-limit controls, among other requirements (Strata, 2011d).
- Perform a safety analysis of the county roads where increased traffic would occur. Potential enhancements could include a decreased truck speed on D and New Haven Roads, or the assignment of "daytime headlight sections" to increase safety.
- Perform routine assessments of road conditions. The MOU between the Applicant and Crook County also includes a maintenance agreement to address road-maintenance needs.
- Explore a coalition with other companies operating heavy trucks on the county roads (e.g., the haulers of bentonite from the nearby mine) to provide additional assistance to Crook County for safety and maintenance needs.

- Work with Crook County to upgrade some portions of the roads by adding gravel to specially identified sections.
- Evaluate the feasibility of an employee carpooling program, or a park-and-ride system, in Gillette or Moorcroft. Alternatives could also include a van-pool system.

These mitigation measures would substantially reduce the transportation impacts associated with the Proposed Action's construction; with mitigation, the impacts of transportation would be SMALL to MODERATE**.**

4.3.1.2 Ross Project Operation

As discussed in GEIS Section 4.4.2, during the operation phase at an ISR facility, the facility-related traffic volume would be unlikely to generate any significant environmental impacts above those expected during the construction phase. Dust, noise, and possible incidental wildlife- or livestock-mortality impacts on or near a facility's access roads could continue to occur. The GEIS concluded that the potential impacts from transportation during facility operation could range from SMALL to MODERATE (NRC, 2009).

What are "best management practices"?

Best management practices (BMPs) are techniques, methods, processes, activities, or incentives that are effective at delivering a particular outcome. BMPs can also be defined as efficient and effective ways of meeting a given objective based on repeatable procedures that have proven themselves over time, such as specific standard operating procedures (SOPs). Well-designed BMPs combine existing managerial and scientific knowledge with knowledge about the resource being protected. The Wyoming Department of Environmental Quality (WDEQ) defines best practicable technology as a "technology-based process determined by WDEQ as justifiable in terms of existing performance and achievability (in relation to health and safety) which minimizes, to the extent safe and practicable, disturbances and adverse impacts of the operation on human or animal life, fish, wildlife, plant life and related environmental values." (WDEQ, 2007, as cited in NRC, 2009b).

The GEIS also assessed the potential for accidents and their consequences when the accidents involve the transportation of hazardous chemicals and radioactive materials. The GEIS recognized the potential for high consequences from a severe accident involving transportation of hazardous chemicals in a populated area. The GEIS stated that the probability of such accidents is low because of the small number of shipments, comprehensive regulatory controls, and the ISR facility operator's use of best management practices (BMP). For radioactive material shipments (for example, yellowcake product, loaded IX resins, or radioactive wastes), compliance with transportation regulations would be expected to limit radiological risk during normal ISR operations. The GEIS concluded there would be a low radiological risk in the unlikely event of an accident. The use of emergency-response protocols would help to mitigate the consequences of severe accidents that involve the release of radioactive materials. This SEIS reviews the radiological consequences of such accidents in Section 4.13.1 (NRC, 2009).

During the operation phase, increased traffic over that in 2010 would be present due to employee traffic; shipments of process chemicals, loaded IX resins, yellowcake, and vanadium; and shipments of solid, hazardous, and radioactive wastes to and from the CPP and/or wellfields. These shipments are included in the truck count in Table 4.2. Potential impacts to other resources could again occur during uranium-recovery operation, as discussed earlier. Impacts to local roads would be less significant during operation than during construction due to the lower traffic associated with facility and wellfield operation, although the traffic on these roads would still be double that in 2010 (Strata, 2011a). In total, the increase in anticipated traffic during the Ross Project's operation phase is significant when compared to current levels, although there are low and manageable risks associated with yellowcake, process-chemical, and waste transportation. Consequently, the transportation impacts during the operation phase would be less significant than during construction and would nonetheless be SMALL to LARGE. However, the magnitude of these impacts would be mitigated by the same measures used during the construction phase. Thus, with mitigation, transportation impacts would be SMALL to MODERATE.

GEIS Section 4.2.2.2 as cited by GEIS Section 4.4.2.2 evaluated yellowcake transportation, and assumed shipment volumes would range from 34 – 145 yellowcake shipments per year. The Applicant estimates that there would be 75 shipments of yellowcake per year from the Ross Project based on the maximum annual production rate (i.e. including yellowcake produced from toll milling), which is within the range of the GEIS analysis (Strata, 2011a). The GEIS indicated that 145 yellowcake shipments per year from a single ISR facility could result in 0.04 and 0.003 cancer deaths per year, depending on the amount of yellowcake released during a transportation accident (NRC, 2009). To minimize the risk of an accident involving yellowcake transport associated with the Proposed Action, the material would be transported in accordance with U.S. Department of Transportation (USDOT), Wyoming Department of Transportation (WYDOT), and NRC regulations, managed as a "low-specific activity" (LSA) material, and shipped on exclusive-use vehicles. Only properly licensed and trained drivers would transport LSA materials. Should a transportation accident occur, the NRC concluded that the consequences of such accidents would be limited because the Applicant would develop emergency-response protocols for yellowcake and other transportation accidents. Also, shipping companies would ensure their personnel receive proper emergency-response training. Emergency-response protocols would include communication equipment and emergency-spill cleanup kits on each vehicle and at the shipping and receiving facilities (Strata, 2011a). Based on this analysis, the impacts due to a potential accident involving the transportation of yellowcake during the operations phase of the proposed Ross Project would be SMALL.

The Applicant estimates that approximately four bulk-chemical, fuel, and other supply and material deliveries would be made per day throughout the operation phase of the Proposed Action (Strata, 2011a). This number of shipments is greater than the daily number of chemical-supply shipments considered in GEIS Section 4.4.2 (estimated at approximately one per day); however, these shipments would be made in accordance with the applicable USDOT hazardous-materials-shipping requirements and spill response would be similar to the response for yellowcake shipments. The Applicant conducted an analysis, using the injury rate of 4.3×10^{-7} per mile, to determine the risk of an injury to a member of the general public that could result from a transportation accident involving the shipment of anhydrous ammonia. The applicant found that these shipments could result in 0.002 injuries per year. The NRC staff reviewed the Applicant's analysis and verified that reasonable input parameters were used. Chemical shipments would be conducted safely and the probability of an accident involving these shipments would be SMALL. As described in GEIS Section 4.4.2.2 and 4.2.2.2, the likelihood of an incident in a populated area would be small, given the precautions that would be taken with hazardous chemical shipments. Therefore, the potential environmental impacts of accidents involving chemical transportation during Ross Project operations would be SMALL.

The CPP is designed to process more yellowcake than is expected to be recovered at the proposed Ross Project (Strata, 2011a). The Applicant indicates that it proposes to accept uranium-loaded IX resins from other ISR operations as well as, potentially, those from offsite domestic-sewage facilities as noted in SEIS Section 2.1.1. The Applicant would expect to receive four shipments of resin per day. GEIS Section 4.2.2.2 as cited in GEIS Section 4.4.2.2 concluded that the potential radiological impacts of IX resins shipments would be lower than the risks from yellowcake shipments based on the less concentrated nature of the resins; the uranium being chemically bound to the resins, which would limit dispersion in the event of a spill; and the small transport distance relative to yellowcake shipments. Although the number of shipments proposed by the Applicant is higher than the one truck per day assumed in the GEIS, the other three factors evaluated in the GEIS would ensure that the probability of an accident that involves uranium-loaded IX resins would be small. Compliance with the applicable NRC and USDOT regulations for shipping IX resins would also reduce the risk of accidents involving these shipments. Therefore, the environmental impacts of accidents involving shipments of IX resins during Ross Project operations would be SMALL

The vanadium extracted by the Applicant in the CPP's vanadium circuit is considered a hazardous material by USDOT and would be shipped in sealed transport vehicles to an offsite processing facility (see SEIS Section 2.1.1) (Strata, 2011a) in accordance with USDOT regulations. It is anticipated that there would be 45 shipments of vanadium from the Ross Project each year. Due to the low number of shipments, the probability of an accident involving vanadium shipments would also be small. Because of the less hazardous nature of vanadium as compared with yellowcake, the environmental impacts of accidents involving shipments of vanadium would be SMALL.

The operation of the Proposed Action would also generate radioactive wastes. These would be shipped in 208-L [55-gal] drums inside sealed roll-off containers in accordance with applicable USDOT regulations. Only five such waste shipments are anticipated during a year; given the infrequent nature of these shipments, they do not represent a significant impact to local traffic conditions or a significant increased risk of accidents. Thus, the impacts of the shipment of radioactive wastes to traffic would be SMALL. Other solid wastes would be transported to a local municipal landfill in Moorcroft, Sundance, and/or Gillette. The Applicant estimates that one trip per week would be required to remove solid waste from the Ross Project. This number would represent a SMALL impact to the local roads, both in terms of traffic volume and impacts to local road maintenance. Finally, the Applicant anticipates that there would be one shipment of hazardous wastes from the Ross Project each month. The hazardous waste is expected to include used oil, oil-contaminated soil, oily rags, used batteries, expired laboratory reagents, fluorescent light bulbs, spent solvents, and degreasers. Given the low number of shipments, this represents a SMALL impact to the local traffic and the local roads and would have SMALL environmental impacts in the case of an accident due to the small volumes generated at the Ross Project.

To mitigate transportation impacts, many of the mitigation measures instituted during the Ross Project's construction would continue during operation. Additional mitigation measures would be implemented for the shipment of materials, such as yellowcake, uranium-loaded IX resins, and vanadium as well as solid, hazardous, and radioactive wastes. Two mitigation measures that would address all such shipments would be 1) coordination with local emergency-response personnel, and 2) the requirement that only appropriately licensed transporters would be used. The Applicant would develop a protocol, or a SOP, to provide ongoing training to local emergency-response personnel, including EMTs, firefighters, and municipal and county law-enforcement personnel. For each type of material, specific information would be provided about the physical and chemical characteristics of the substances being shipped, the related hazards, the potential exposure pathways, and appropriate spill-response, containment, and cleanup procedures. This training would be ongoing and would include updates on a routine schedule or as new substances are transported to or from the Ross Project. All shipments would be made by appropriately licensed transporters in accordance with USDOT and WYDOT hazardous-material regulations and requirements.

The release of a radioactive material as a result of a transportation-related incident would prompt the activities described in USDOT's hazardous-materials regulations at 49 *Code of Federal Regulations* (CFR) 171, Subpart B, "Incident Reporting [and] Notification." Among other activities, these regulations require immediate notice of certain incidents, preparation of detailed incident reports, submission of examination reports, and assistance with investigations and special studies. Should an accident occur that results in a release of any yellowcake or other radioactive materials to the environment, the Applicant would perform a post-cleanup radiological survey of the affected area to ensure that there are no long-term hazards associated with the released radioactive material or of spill-response and cleanup activities.

4.3.1.3 Ross Project Aquifer Restoration

As discussed in GEIS Section 4.4.2, the potential transportation impacts during aquifer restoration would be equal to or less than the potential impacts during ISR facility operation (NRC, 2009). At the Ross Project, the number of uranium-recovery workers, and therefore the number of personal vehicles, would decline significantly during aquifer restoration from the construction and operation phases (from 200 to 60 to 20 workers). Thus, the potential transportation impacts discussed above for the Ross Project's construction and operation would be reduced due to the anticipated smaller traffic volume during this phase of the Project.

Yellowcake, vanadium, and uranium-loaded IX-resin shipments could remain the same if the CPP continues to process uranium-loaded IX resins during the Ross Project wellfield's aquifer restoration. The shipments of process chemicals would similarly depend upon whether the CPP would continue to process loaded resins after the Ross Project's wellfields are no longer engaged in uranium recovery. Should the CPP continue to process loaded IX resins, there would not be a reduction in worker commuting as discussed above.

However, the impacts would be similar to those during uranium-recovery operation at the Ross Project, and these would be expected to be SMALL to MODERATE due to the workforce of 60 or 20 workers. Mitigation measures implemented during aquifer restoration at the Ross Project would be identical to those implemented during its construction and operation phases.

4.3.1.4 Ross Project Decommissioning

During ISR facility decommissioning, the GEIS concluded that transportation impacts as a result of worker commutes would steadily decrease, but initially there would be a large increase in decommissioning-phase workers. GEIS Section 4.4.2 also concluded that, based on the concentrated nature of yellowcake when shipped, the longer distance of the yellowcake shipments when compared to waste shipments, and the number of shipments when compared to byproduct waste shipments, the potential radiological risks from transportation accidents involving byproduct waste shipments during decommissioning would be bounded by the yellowcake transportation risks during operations. Overall, according to GEIS Section 4.4.2, transportation impacts would be SMALL (NRC, 2009).

During the decommissioning phase of the Ross Project, the Applicant expects that the workforce would initially increase to approximately 90 workers (up from 20 workers during aquifer restoration). Traffic on the local roads would thus increase over that of the aquifer-restoration phase, but it would still be less than half of that expected during the Proposed Action's construction phase. Fuel shipments would increase due to the operation of heavy equipment during decommissioning activities. Little or no yellowcake or vanadium would be shipped during the decommissioning phase; however, Project decommissioning would result in an increase in shipments of radioactive and other solid wastes. The Applicant estimates that the frequency of radioactive-waste shipments would increase from the approximately 5 per year during the operation and aquifer-restoration phases, to between 100 – 200 shipments per year during the decommissioning phase (Strata, 2011a). These shipments would still be relatively infrequent compared to passenger vehicular traffic, and they would have only a small impact on traffic volume. Solid-waste shipments are expected to increase from approximately one per week during operation and aquifer restoration to about two per week during decommissioning. Hazardous-waste shipments are expected to remain unchanged at approximately one per month throughout all four Proposed Action phases.

As anticipated in the GEIS, the potential radiological risks associated with transportation accidents involving byproduct waste shipments during decommissioning at the Ross Project would be bounded by the risks associated with transporting yellowcake during operations. The GEIS assumed that the distance between the yellowcake conversion facility and the proposed project would be greater than the distance between the waste disposal facility and the proposed project. Consistent with the GEIS, the distance from the Ross Project area to the conversion facility that would accept the yellowcake is 2,029 km [1,260 mi] whereas the byproduct waste would travel between 378 km [235 mi] to 1,610 km [1,000 mi] to a disposal facility. The GEIS also assumed that there would be up to 145 yellowcake shipments per year and 300 total byproduct material shipments during decommissioning (based on 4,593 m^3 [6,008 yd^3] of byproduct material generated during decommissioning and each shipment containing 15 m^3 [20 yd^3] of byproduct material), which would result in more yellowcake shipments than byproduct material shipments overall. The Applicant estimates that there would be 75 shipments of yellowcake per year during operations and 3,823 m^3 [5,000 yd^3] of byproduct material generated during decommissioning (250 total shipments of byproduct material during decommissioning), which would also result in more yellowcake shipments than byproduct material shipments overall.

Potential transportation impacts would be less during decommissioning than those occurring during construction; however, they would be still be SMALL to MODERATE due to the increased workforce required for decommissioning (approximately 90 workers). Mitigation measures implemented during the Proposed Action's decommissioning would be identical to those that would be implemented during all of the other phases of the Ross Project.

4.3.2 Alternative 2: No Action

Under the No-Action Alternative, the Ross Project would not be licensed and the land would continue to be available for other uses. However, traffic volumes and patterns would likely increase from the 2010 pre-licensing baseline conditions noted in SEIS Section 3.3 because additional residences could be expected to be built near the Ross Project over time. The Applicant has projected that volumes would increase approximately 2 percent per year, even without the Ross Project's construction and operation (Strata, 2011a). There would be no transportation of materials of any kind to or from the Ross Project to support uranium-recovery activities. There would be no transportation of either radioactive or solid wastes from the Proposed Action because the Ross Project would neither be licensed nor constructed and operated. The current transportation activities to support ongoing oil production and bentonite mining would be the same. In addition, the Applicant would continue with some preconstruction activities, such as abandonment of exploration drillholes and collection of environmental data. These activities are similar to those currently occurring at the Ross Project area, and, although short-term increases in activity could occur, these impacts would be SMALL.

4.3.3 Alternative 3: North Ross Project

Under Alternative 3, the North Ross Project would generally be the same as the Proposed Action, except that the facility (i.e., the CPP, associated buildings, and auxiliary structures as well as the surface impoundments) would be located to the north of where it would be located in the Proposed Action, as described in SEIS Section 2.1.3. This change in facility location would cause a change in the impacts to local roads as compared to current conditions, because additional roads would be used that would not be used during the Proposed Action at the south site—most notably, the Oshoto Connection and the D Road north of the D Road/New Haven Road intersection (see Figure 2.1 in SEIS Section 2). There would likely be less localized impact to the New Haven Road, as it is anticipated that the majority of the traffic from the Proposed Action would access the Ross Project area by travelling D Road to the Oshoto Connection (Strata, 2011a). Although this change would minimize impacts to the New Haven Road, it would nevertheless cause a corresponding increase in impacts to the D Road and the Oshoto Connection as both roads are similarly constructed and maintained. Since the total traffic counts would remain the same during all phases of Alternative 3 as those for the Proposed Action, the transportation impacts would be the same as those described earlier for Alternative 1, SMALL to LARGE. As the same mitigation measures discussed for the Proposed Action would be employed for Alternative 3, the resulting transportation impacts would be SMALL to MODERATE.

4.4 Geology and Soils

4.4.1 Alternative 1: Proposed Action

Alternative 1, the Proposed Action, consists of four phases: construction, operation, aquifer restoration, and decommissioning of a uranium-recovery facility and wellfields.

4.4.1.1 Ross Project Construction

As described in GEIS Section 4.2.3 and 4.4.3, the principal impacts to geology and soil during construction would result from disturbance of soil and surficial bedrock by construction activities. These activities include the Applicant's clearing ground or topsoils, eliminating the vegetation that is present; cutting, filling, and grading the ground surface, preparing it for the construction of the CPP, surface impoundments, access roads, utility corridors, and wellfields; excavating and backfilling trenches for pipelines and other subsurface design components; and excavating the mud pits, CBW, and flood-control diversion channel (NRC, 2009). As the GEIS noted, the impacts on geology and soils from construction activities depend upon local topography, surface bedrock geology (i.e., the rock immediately below the soil), and soil characteristics. The GEIS concluded that, with the implementation of appropriate BMPs, the impacts on geology and soils would be SMALL, if less than 15 percent of an ISR project's area would be affected. As described earlier in SEIS Section 4.2, approximately 113 ha [280 ac] of land, or about 16 percent of the Ross Project area, would be disturbed during the lifecycle of the project (Strata, 2011b). This area is slightly larger than that identified in the GEIS; thus, a site-specific analysis is provided here.

Geology

Construction activities are not expected to encounter bedrock, except for localized impacts to the surficial bedrock by construction of the CBW. The wall would be a 0.7-m- [2-ft] wide barrier of a soil-bentonite mixture extending from the surface to at least 0.7 m- [2 ft-] into bedrock. The impacts of the CBW's construction would be SMALL, due to the relatively small and localized effects on the bedrock below it.

The impacts from the Applicant's drilling and developing injection, recovery, and monitoring wells as well as installing the deep-injection wells are discussed in SEIS Section 4.5.

Soils

The impacts on soils would occur largely during the construction phase of the Proposed Action, when most of the ground disturbance takes place. Potential soils impacts include soils loss (by wind and water erosion), soils compaction, increased salinity, soils-productivity loss, and soils contamination. Surface-disturbing activities would expose the soils and subsoils at the Ross Project area and would temporarily increase the potential for soil loss because of wind and water erosion. As described in SEIS Section 3.4.2, the soils in the Ross Project area have a moderate to severe potential to be affected by wind erosion. One soil type, Vona fine sandy loam—which makes up less than 3 percent of the entire Ross Project area—has a severe potential for wind erosion. Water-erosion hazards range from negligible to moderate for the soil types found within the Ross Project area.

Soils at the Ross Project also have the potential to become compacted, particularly during construction activities where heavy equipment is being operated. Soil compaction could result in a decrease in water infiltration, thereby increasing runoff. To decrease the potential for compaction, existing roads would be used where possible; secondary access-road widths would be minimized, and a one-way-in/one-way-out policy would be implemented by the Applicant to access wellfields. Compacted soils would be further addressed in the decommissioning plan (DP) that the Applicant would be required to submit to the NRC (Strata, 2011a).

During preconstruction activities, the Applicant has been employing various methods of soil reclamation, according to landowner preference. These methods have included Strata's "ripping" compacted soil with the teeth of a grader, loosening compacted soil with a disk, or simply replacing topsoil and reseeding. These techniques would continue to be refined and coordinated with WDEQ/LQD and the respective landowners during the Proposed Action.

Saline soils are very susceptible to soil loss. Saline soils were not found on the Ross Project during the Applicant's soil surveys. However, the use of magnesium chloride for dust control could increase the salinity of the local soils (Strata, 2011a). If magnesium chloride were to be used on access roads for fugitive-dust control or if a salt and sand mixture were to be used for traction on primary access roads during the winter, the Applicant would sample the soils beneath and adjacent to access roads for salinity during the Proposed Action's decommissioning phase. Any salt-impacted soils would be removed at that time.

Loss of topsoil and disturbance of soils could affect the soils' structure and microbial activity. In turn, these changes could reduce soil productivity. Based upon the total anticipated disturbance area of 113 ha [280 ac] and the average topsoil depth of 0.53 m [1.7 ft], the volume of topsoil stockpiled during the life of the Proposed Action is estimated to be up to approximately 600,000 m^3 [800,000 yd^3] (Strata, 2011b). This estimate could be conservatively high because most of the wellfields and access roads would be located outside of the 100-year floodplain at the Ross Project area, where topsoil would be thinner than average. This volume of topsoil would generally not be removed from access roads to and from the wellfields, and much of the topsoil would be replaced promptly after removal for pipeline and utility-corridor trenching.

To mitigate the potential loss of top soil as well as soil productivity, topsoils would be salvaged and stockpiled for wellfield-decommissioning and site-restoration activities. Sequential wellfield decommissioning is anticipated by the Applicant; once a wellfield is depleted, it would be decommissioned and the field's wells properly abandoned. This decommissioning would occur as each wellfield is taken out of service; it would not be delayed until the end of the entire Ross Project's lifecycle.

The Applicant proposes to locate a relatively large topsoil stockpile near the CPP (see Figure 2.5 in SEIS Section 2.1.1) (Strata, 2011a). Any topsoils that are stripped before the construction of roads and drilling pads in the wellfields would be stockpiled in nearby piles, typically spaced approximately 600 m [2,000 ft] apart along access roads to minimize the soil compaction, fugitive dust, combustion gases, and noise associated with long topsoil hauls.

Related mitigation measures designed to minimize soil loss, and to diminish fugitive dust (see SEIS Section 4.7.1.1) would include the Applicant: 1) constructing topsoil stockpiles on the leeward side of hills, where possible; 2) constructing topsoil stockpiles away from ephemeral-stream channels or any other flood-prone areas; 3) avoiding construction within areas susceptible to flooding; 4) minimizing the disturbance of surface-water drainages (i.e., roads and pipelines would cross drainages perpendicular to the flow direction [as described in SEIS Section 3.4.2]); 5) wetting exposed soils during construction to minimize soil loss from wind erosion; 6) employing sediment-control BMPs, such as silt fences, sediment logs, and straw-bale check dams in all disturbed areas; 7) implementing additional sediment-control BMPs for topsoil stockpiles, including seeding and installing a perimeter ditch and water-collection sump to trap storm water and sediment; and 8) restoring and reseeding disturbed areas as quickly as possible, typically within a single construction season (Strata, 2011a; WDEQ/LQD, 2005). Many of these BMPs are consistent with those identified by NRC in the GEIS in Section 7.4 and are commonly used at other ISR facilities (Strata, 2011a; NRC, 2009b).

To minimize soil-productivity impacts, the Applicant would use corresponding BMPs including several of the mitigation measures identified above to prevent soil loss. These BMPs include the Applicant 1) protecting topsoil stockpiles from wind and water erosion; 2) seeding topsoil stockpiles during inactive periods with an appropriate perennial seed mix; 3) redistributing topsoil and applying a permanent seed mix approved by WDEQ/LQD during the Proposed

Action's decommissioning phase; and 4) using information gathered from reference areas over the long term to perform statistical, quantitative, and qualitative comparisons approved by WDEQ/LQD.

Although the subsurface would be exposed during the Applicant's excavation of mud pits and pipeline trenches, the primary area of subsoil disturbance would be where the CPP and surface impoundments are to be constructed. The subsoils there would be disturbed by the cut, fill, and grading activities necessary to create a relatively level site and by the excavations for the surface impoundments, CBW, and flood-control diversion channel. The quantity of excess subsoils generated from construction of the CPP and surface-impoundment area is estimated to be approximately 60,000 m^3 [80,000 yd^3]. This material could be used to provide a slightly elevated and relatively level primary access road, or it could be stored in a subsoil stockpile separate from the topsoil stockpiles.

During the Proposed Action's construction, additional potential soil impacts could occur from the introduction of drilling fluids and muds to the soils near the recovery, injection, and monitoring wells. However, the volume of these drilling fluids would be small, and these fluids and muds would be contained within the mud pits excavated near each drillhole's drilling pad. Other potential soil impacts could also occur from spills and leaks of fuel or lubricants from heavy-construction equipment and passenger vehicles that would be operated during construction of the Ross Project. However, such spills and leaks would be contained and cleaned up immediately if they were to occur. Oil- or lubricant-contaminated soil would be disposed offsite in an appropriately permitted facility.

During construction, up to five Class I deep-injection wells would be installed in aquifers approximately 2,000 m [6,400 ft] below ground surface (bgs). These wells would be used for the disposal of process solutions, including brine and excess permeate. The Applicant's drilling of these wells and their completion and testing would be governed by the applicable Underground Injection Control (UIC) Class I Permit from WDEQ (WDEQ/WQD, 2011). Thus, the surface and subsurface area disturbed by these particular wells would be very limited.

Therefore, the potential impacts of the Proposed Action's construction to soils would be SMALL.

4.4.1.2 Ross Project Operation

As described in GEIS Section 4.4.3, the potential impacts to geology and soils during the operation of an ISR facility could include: soil loss due to surface-water runoff and erosion; soil compaction as described above; increased soil salinity due to the use of magnesium chloride for dust control; soil contamination caused by spills and leaks of lixiviant, as the solution moves through pipelines between the wellfields and the CPP; transportation accidents, which could involve liquids; other accidental spills and leaks associated with waste management; and changes to the uranium-bearing formations as a result of the disposal of brine and other liquid byproduct wastes in UIC Class I deep-injection wells. The GEIS concluded that the impacts on geology and soils from an ISR operation would be SMALL.

<u>Geology</u>

During uranium-recovery operation, the lixiviant dissolves the uranium-mineral coatings on the sandstones in the targeted ore zone; this geochemical change in the rock would result in mineralogical changes to the ore zone, but it would not affect the rock matrix nor rock structure. The thickness and depth of the ore zone at the Ross Project are similar to the ore zones evaluated in the GEIS (NRC, 2009). The GEIS concluded that it is unlikely that geochemical alteration of the ore zone would result in any compression or subsidence that would be translated to the ground surface.

Based upon historical uranium-recovery operations in the NSDWUMR, reactivation of geologic faults would not be anticipated (NRC, 2009b; Strata, 2011b). As established in SEIS Section 3.4.4, earthquake activity in the area of the Ross Project is very low. Potential impacts associated with increased earthquake risk because of the operation of injection wells would be avoided by Applicant's maintaining the injection pressure at a level that does not exceed the fracture pressure of the receiving rock formation, as specified in the WDEQ/Water Quality Division (WQD) permit. See SEIS Section 2.1 for a related discussion of how in situ uranium recovery is different than hydrofracking.

The potential impacts from the operation of the Proposed Action to Ross Site geology would be SMALL.

Soils

During the operation of the Proposed Action, potential impacts from soil loss would be minimized by proper design and operation of surface-runoff features and implementation of BMPs, as described for those during construction. Soil compaction would be minimal during the Proposed Action's operation, due to low density of roads across the Ross Project area. Mitigation measures to minimize soil compaction and to diminish increases in soils salinity would be the same as those identified for the construction phase of the Proposed Action. The potential for a release of yellowcake or IX resin during a transportation accident has been determined by NRC to be small; however, the magnitude of the impacts of this type of accident is described in SEIS Section 4.2 (NRC, 2009).

In the event of releases of process solutions from pipelines, module buildings, process vessels, or surface impoundments, the process-control system described in SEIS Section 2.1.1.2 would quickly alert an operator, who could then take action including a full shutdown of the leaking components as well as initiating immediate containment and cleanup. As noted in the GEIS, during 1996, the operator of the Crow Butte Uranium Project in Dawes County, Nebraska, logged 27 spill incidents of process solutions, with volumes ranging from 45 – 65,000 L [12 – 17,305 gal] (NRC, 2009). This potential for soil contamination at the Ross Project would be minimized by the Applicant: 1) adhering to the NRC and WDEQ design criteria for uranium-recovery facilities; 2) designing successful spill-containment and leak-detection systems; 3) training employees on monitoring process parameters and recognizing potential upset conditions before spills or leaks occur; 4) training employees on inspection SOPs, spill-control BMPs, and a storm water pollution prevention plan (SWPPP); 5) frequently inspecting waste-management systems and effluent-control systems; and 6) training all employees on spill detection, containment, and cleanup procedures (Strata, 2011a). Additional information on the excursion-monitoring and spill-detection systems incorporated into the design of the Ross Project is presented in SEIS Section 2.1.1 of this SEIS.

The design criteria for the Proposed Action include leak-detection capability in each wellfield module building, where an alarm inside the CPP would signal the on-duty operator that a spill has occurred. (The CPP would be staffed 24 hours a day.) In addition, routine, weekly inspections of wellfield module buildings and wellheads would be conducted by Strata personnel. Such inspections would ensure that all piping and equipment, wellheads, and valve manholes are visually inspected (Strata, 2011b). Other wellfield leak-detection monitoring and control measures would include the continuous measurement of flows and pressures for injection and recovery trunk lines and feeder lines as well as the presence of leak-detection sensors in valve manholes and in the protective box around each wellhead. In addition, all pipelines would have been hydrostatically tested before they were buried, and the Applicant would institute a monitoring program for leaks and other abnormalities as required by the NRC license (Strata, 2011b).

To minimize the potential for subsurface pipeline leaks, the WDEQ/WQD requirements for potable-water stream crossings would be incorporated into the design and construction of all pipeline stream crossings. These requirements include the Applicant: 1) providing a minimum of 0.6 m [2 ft] of soil cover (at the Ross Project, 1.2 – 1.8 m [4 – 6 ft] would typically be used) over the respective pipelines to guard against damage from livestock and to protect them from freezing; 2) using pipes with flexible, watertight joints, such as polyvinyl chloride (PVC) or high-density polyethylene (HDPE); and 3) installing accessible isolation valves at both ends of water crossings so that the section could be isolated for testing or repair.

Two levels of engineering controls would also minimize potential impacts to soils from the unintended release of process solutions within the CPP itself. The first level of protection is the primary containment accomplished by pipelines, vessels, and surface impoundments, all of which would be tested for leaks during construction. The second level of protection is the secondary containment that is provided by curbs, berms, and sumps for all chemical-storage tanks, process vessels, and all piping and equipment inside the CPP building (Strata, 2011a).

The design and operation of the surface impoundments would also minimize the likelihood of liquid releases. The surface impoundments would include a double-liner and leak-detection system, and they would be operated so as to maintain sufficient reserve capacity to permit the Applicant to transfer the contents of a surface-impoundment cell to another in the event of a leak, in order to facilitate repair or replacement. To minimize the likelihood of releases, impoundment embankments would be monitored and inspected weekly by the Applicant in accordance with NRC-approved inspection protocols (Strata, 2011a).

Further, to minimize the potential impacts of soil contamination, such as short-term, elevated concentrations of radiological parameters and other associated chemical constituents above baseline levels, the Applicant would be required to establish immediate spill detection, response, containment, and cleanup protocols and SOPs (NRC, 2009) by its NRC license. For example, immediate spill response could include the Applicant shutting down the leaking pipeline, recovering as much of the spilled fluid as possible, and collecting samples of the impacted soils for comparison of constituent-concentration values (e.g., uranium, radium, and other indicators) to baseline conditions. Soils contaminated by spills or leaks would be removed in accordance with Criteria 6(6) of Appendix A to 10 CFR Part 40, which requires that soil concentrations not exceed background concentrations by more than 0.2 Bq/g [5 pCi/g] of radium-226, averaged over the first 15 cm [5.9 in] below the ground's surface. Analytical tests would be required to demonstrate that no such residual contamination exists. Baseline concentrations have been established by the Applicant through its pre-licensing, site-characterization monitoring program (see SEIS Section 3.12.1), and additional determination of background values would have been established by a post-licensing, pre-operational monitoring program prior to major Ross Project construction. Soils contaminated by spills or leaks would be properly disposed of at an offsite properly licensed and permitted disposal facility (Strata, 2011a).

The NRC's monitoring requirements would specify that licensees must report designated types and volumes spills to the NRC within 24 hours (NRC, 2009). These spills include those that cause unplanned contamination that meets the criteria at 10 CFR Part 40.60 as well as those spills that could cause public or occupational exposures that exceed the limits established in 10 CFR Part 20, Subpart M (see SEIS Section 4.13). Additional reporting requirements could be imposed by the State or by NRC license conditions. The spill response requirements would be defined in the NRC license. All of these spill-response protocols would be implemented if other liquid radioactive or chemical materials or wastes, or if solid radiologically and/or chemically contaminated materials or wastes, were to be spilled or dispersed.

Potential impacts to the soils at the Ross Project would be mitigated by the Applicant's implementation of BMPs and other spill-related procedures, plans, and programs that would be required in the NRC license. As noted above, all contaminated soils and sediments would be removed and disposed of according to the requirements of the 10 CFR Part 40, Appendix A. These mitigation measures would substantially minimize the impacts to the soils and sediments of the Ross Project area; these impacts would be SMALL.

4.4.1.3 Ross Project Aquifer Restoration

As described in GEIS Section 4.4.3, aquifer restoration would impact the geology of the deep-injection aquifers similarly to the operation of an ISR facility. With respect to ore-zone and soils, the potential for accidental spills and leaks would be similar, but less than, those described for the operation phase. Lixiviant would not be used during aquifer restoration so there would not be potential impacts to geology from dissolution of uranium and other constituents from the ore zone. As the quality of ground water from the exempted aquifer improves during restoration, the potential impacts of process-solution spills or leaks from pipes and pumps would decrease compared to potential impacts during operations. The GEIS determined that the potential impacts to geology and soils would be SMALL.

The potential impacts to Ross Project geology and soils associated with aquifer restoration at the Ross Project would be similar, but less, than those associated with its operation. The relative magnitude of impacts would be less because the concentrations of radionuclides, metals, and TDS in the water moving through the pipes, pipelines, and injection and recovery wells would be lower during aquifer restoration than during uranium-recovery operation. Also, there would less transport of uranium-bearing solutions and fewer shipments of yellowcake or vanadium; thus, less potential for spills and leaks than during operation. As previously described for the operation phase of the Ross Project, impacts to soils resulting from spills would be concentrations of radionuclides and other chemical constituents above established baseline or background values, but these elevated concentrations would be eliminated upon spill cleanup. Thus, the potential impacts of the Proposed Action's aquifer restoration to geology and soils would be SMALL.

4.4.1.4 Ross Project Decommissioning

GEIS Section 4.4.3 described the activities associated with the decommissioning of an ISR facility, including decontamination of surfaces, dismantling of process components and associated structures, demolishing buildings and other structures, removal of buried pipelines, and plugging and abandonment of wells and wellfield components (NRC, 2009). The GEIS determined that most of the impacts to geology and soils during the decommissioning phase would be short-term and SMALL. In fact, because the goal of decommissioning and site restoration is to restore, to the extent practical, the environment to preconstruction conditions through activities such as redistributing, seeding, and contouring soil that would have been stockpiled during the earlier phases of the Ross Project, the overall long-term impacts to geology and soils would be SMALL (NRC, 2009).

Geology

The potential impacts to the geology of the ore zone at the Proposed Action would depend upon the density of plugged and abandoned drillholes and wells. At the end of the life of the Ross Project, the wellfields (whether recently operated or decommissioned some time ago) would contain approximately 3,000 drillholes and wells; these would include those drillholes from Strata's ore-zone delineation efforts and geotechnical investigations, ground-water monitoring wells used for site characterization, the injection and recovery wells from uranium-recovery activities, and Nubeth Joint Venture (Nubeth) drillholes and wells. This would represent an average density of approximately 4.3 wells/ha [1.7 wells/ac]. All of these drillholes and wells would be properly abandoned by the Applicant with concrete or a similar material. Each drillhole and well would be required to be filled with a concrete plug up to 15 cm [6 in] in diameter, through the entire depth of the drillhole or well (WDEQ/LQD, 2005). The density of these concrete plugs is not great enough to alter the geology of the ore zone nor the surrounding stratigraphy. As described in SEIS Section 2.1.1.1, well-abandonment records would be maintained onsite at the Ross Project until termination of its NRC license. The impacts to ground water from improperly abandoned drillholes and wells are discussed in SEIS Section 4.5.

Potential impacts to the geology of the deep-injection aquifers (i.e., the Flathead and Deadwood Formations) would also be similar, but have less magnitude, than during the aquifer-restoration phase, because there would be only minimal volumes (less than 38 L/min [10 gal/min]) of liquid byproduct wastes injected into the Class I deep-disposal wells during the decommissioning phase.

The surficial bedrock would be affected locally by the actions necessary to breach the CBW to re-establish aquifer flow. The potential impacts from these relatively small and local effects on bedrock beneath the CBW would be SMALL as would all impacts related to geology.

Soils

The potential impacts to Ross Project area soils during the decommissioning of the Proposed Action would result from activities associated with land reclamation and site restoration, including the excavation and cleanup of contaminated soils. These decommissioning impacts would be similar to those resulting from construction of the Proposed Action. The BMPs, SOPs, and other mitigation measures described earlier for the construction and operation phases would continue to be implemented. Thus, the potential impacts from decommissioning activities to the local soils would be SMALL.

4.4.2 Alternative 2: No Action

Under the No-Action Alternative, the Ross Project would not be licensed and the land would continue to be available for other uses. However, until that decision is made by the NRC, the impacts of soils compaction and soils loss by heavy equipment and vehicular traffic across the Ross Project area could occur during the Applicant's continuing conduct of: 1) different types of surveys (e.g., continued ecological surveys); 2) boring of exploration and geotechnical drillholes; 3) drilling and monitoring of all types of ground-water wells; 4) locating and abandoning Nubeth drillholes and wells; and 5) installing and observing surface-water and meteorological monitoring stations.

As of August 2011, the Applicant had drilled and then plugged approximately 612 holes it installed during site characterization, geotechnical investigation, and ore-zone delineation; an additional 51 were also drilled and are now used as pre-licensing site-characterization ground-water monitoring wells. The Applicant has also located and properly abandoned 55 Nubeth drillholes. Under the No-Action Alternative, the 51 drillholes would need to be responsibly abandoned by the Applicant, plugging the full depth of the drillhole or well with concrete. However, the potential impacts of all of these preconstruction and current activities would be short-term, and the related traffic over the Ross Site area would be low density and minimal. Thus, neither the geology nor the soils would sustain significant impacts; the impacts to the geology and soils as a result of Alternate 2 would be SMALL.

4.4.3 Alternative 3: North Ross Project

Under Alternative 3, the North Ross Project would generally be the same as the Proposed Action, except that the facility (i.e., the CPP, associated buildings, and auxiliary structures as well as the surface impoundments) would be located to the north of where it would be located in the Proposed Action, as described in SEIS Section 2.1.3. The geology and soils at the north site are similar, but there are a few important differences. The most important difference is that the north site slopes to the southeast at a grade of 5 – 15 percent, where the slope at the Proposed Action's facility location, the south site, has a significant percentage of ground surface with less than 1 percent slope. Given that the cells in the surface impoundments have approximate dimensions of 75 m x 165 m [250 ft x 540 ft], significant additional grading would be necessary to construct the surface impoundments at the north site as compared to the south site's location. Also, given that the use of above-grade embankments (to minimize the volume of release during a catastrophic failure) should be minimized from engineering and environment-protection points of view, then the maximum depth of excavation to create each impoundment at the north site would be on the order of 4 – 12 m [13 – 40 ft], with an impoundment depth of 4.6 m [15 ft] and slopes of 5 – 15 percent. It is estimated that the north site would require the grading of an additional 0.4 – 1.2 ha [1 – 3 ac] to accommodate the sloping site.

The additional construction effort associated with these deeper cuts and larger disturbed areas would result in greater soils impacts than those resulting from Alternative 1, the Proposed Action. In addition, these deep cuts would likely encounter bedrock within 1.5 – 7.5 m [5 – 25 ft], increasing the cost and complexity of the construction activities. Embankments could reduce the depths of the excavations, but they would increase the volume of a potential release of process solutions and other liquid byproduct wastes if a catastrophic release were to occur.

Another important difference between Alternative 3 and the Proposed Action is that the north site is not underlain by shallow ground water and, thus, a CBW would not be required. As a result, the soils loss and soils compaction associated with construction of the CBW at the south site would not occur under Alternative 3.

The potential impacts to geology and soils from construction of Alternative 3 would be SMALL and similar to the Proposed Action. In addition, the potential impacts to geology and soils from the operation and aquifer restoration of Alternative 3 would be the same as those of the Proposed Action and would be SMALL.

Alternative 3 would also result in similar impacts to the geology and soils of the Ross Project area during the Proposed Action's decommissioning, except for activities associated with the decommissioning of the surface impoundments. The larger surface impoundments would require larger areas of recontouring and revegetation during site restoration, which would result in a marginally greater potential for the soils loss and soils compaction. However, the impacts to the surficial geology and soils as a result of the Applicant's cutting through the CBW to re-establish aquifer flow in the Proposed Action would be eliminated. In total, the potential impacts to geology and soils during the decommissioning of Alternative 3 would be SMALL.

4.5 Water Resources

The Proposed Action could impact water resources, both surface and ground waters, during all phases of the Project's lifecycle. As discussed in Section 3.2.4, surface and ground waters in the Ross Project area are currently used for livestock and wildlife watering, crop irrigation, and enhanced oil recovery (EOR). The largest water right within 3 km [2 mi] of the Ross Project area is Permit No. P6046R for the Oshoto Reservoir with a permitted capacity of 21 ha-m/yr [173 ac-ft/yr]. The Applicant proposes to convert this water right for use at the Ross Project (Strata, 2011a). The Applicant would have the option of providing alternative sources of water to supply the EOR operation. This section describes the potential impacts to water resources and the corresponding mitigation measures the Applicant proposes throughout the Proposed Action's lifecycle as well as those of the two other Alternatives.

4.5.1 Alternative 1: Proposed Action

Alternative 1 consists of four phases: construction, operation, aquifer restoration, and decommissioning of an ISR uranium-recovery facility and wellfields.

The Ross Project has the potential to impact quantity and quality of surface and ground waters to varying degrees during each phase of the project. The Applicant intends to use local water for the construction of the facility and wellfields, operation of the Proposed Action, and its aquifer restoration, and decommissioning phases. Consumptive ground-water use results from the Applicant injecting 1.25 percent less water than is withdrawn during uranium-recovery operation. Non-production surface- and ground-water use for domestic needs, dust control, and agricultural irrigation is provided in the Table 4.3.

Table 4.3
Estimated Non-Production Water Use

Type of Use	Source	Typical Water Usage (L/min [gal/min]) Construction	Operation	Restoration	Decommissioning
Domestic	Ground Water	3.4 [0.9]	7.2 [1.9]	6.1 [1.6]	6.8 [1.8]
Dust Control	Surface Water	27.2 [7.2]	13.6 [3.6]	13.6 [3.6]	27.2 [7.2]
Irrigation	Ground Water	0.4 [0.1]	0.4 [0.1]	0.4 [0.1]	0.4 [0.1]
Construction	Surface Water	60.2 [15.9]	31.4 [8.3]	0.0	31.4 [8.3]
	TOTAL	91.2 [24.1]	52.6 [13.9]	20.1 [5.3]	48.8 [12.9]

Source: Modified From Strata, 2012a.

The Applicant anticipates that ground water from the shallow-monitoring (SM) zone would be used for domestic purposes and agricultural irrigation, while surface water from either the Oshoto Reservoir or the Little Missouri River would be used for road and construction dust control. Although the GEIS Section 4.4.4.1 did not address consumptive use of surface water, and it assumed that all required water uses would be provided by ground water, the analysis of impacts to ground water and surface water is nonetheless applicable due to the fact that process water from ground water is the largest component of Ross Project water use.

In addition, the Applicant proposes BMPs consistent with those identified by NRC as commonly employed at ISR facilities and that are summarized in GEIS Section 7.4 (Strata, 2011a; NRC, 2009b).

4.5.1.1 Ross Project Construction

Surface Water

As described in GEIS Sections 4.2.4.1.1 and 4.4.4.1.1, the potential impacts to surface waters that could result from the construction of the Proposed Action include land clearance and disturbance for buildings and auxiliary structures as well as the surface impoundments, wellfields, pipelines, access roads, and utilities; stream-channel disturbance for limited periods and minor wetland encroachment. In addition, spills and leaks of fuels and lubricants as well as the discharge of well-drilling fluids from installation, development, and testing of wells could potentially impact surface-water quality. The potential for these impacts would be mitigated through proper planning, thoughtful design, sound construction methods, permit requirements, and BMPs as described in GEIS Section 7.4 (NRC, 2009). The GEIS considered that changes to stream flow (from land grading and other topographic changes) and to natural drainage patterns would be mitigated or restored after the ISR facility's construction phase is complete. Additionally, while impacts from incidental spills into surface water drainages could occur, they would be expected to be only temporary. The quality of storm water discharged during the construction phase would be controlled by permits from cognizant regulatory authorities. The GEIS concluded that potential impacts to surface water during the construction phase of an ISR facility would be expected to be SMALL to MODERATE, depending upon site-specific conditions.

The Applicant intends to use approximately 88 L/min [23 gal/min] of surface water from either the Oshoto Reservoir or the Little Missouri River for dust control during construction (see Table 4.3). This equates to an annual use of 4.6 ha-m [37 ac-ft/yr], significantly less than the currently permitted annual appropriation for Oshoto Reservoir of 21 ha-m [173 ac-ft/yr]. Thus, the potential impacts of the Proposed Action's construction to surface-water quantity would be SMALL.

Suspended-sediment concentrations in storm water at the Ross Project area could be increased due to vegetation removal and soil disturbance during construction of the Proposed Action. The Applicant estimates that 45 ha [110 ac], or 7 percent of the Ross Project area, would be disturbed by the end of the construction phase (Strata, 2011a). Given this disturbance, the Applicant would need to obtain a "Large Construction General WYPDES Storm Water Permit" from WDEQ/WQD for the Proposed Action. Under this Permit, the Applicant would be required to implement a SWPPP to address storm-water runoff during construction activities. The SWPPP would describe the nature and sequence of construction activities, identify potential sources of pollution, and describe the BMPs that must be used, including erosion and sediment controls (e.g., silt fences, sediment logs, and/or straw-bale check dams) and operational controls (e.g., housekeeping, signage, and/or hydrocarbon storage requirements).

In addition, the construction of a single well (injection, projection, or monitoring) would generate a quantity of drilling fluid estimated at 22,700 L [6,000 gal] and about 11 m^3 [15 yd^3] of drilling muds. In total 1,500 – 2,000 wells would be drilled and the wastes generated could potentially impact water quality. However, the wells would be drilled at different times throughout the Project. The drilling fluids and muds would be contained in a mud pit constructed near the well that is being installed to prevent discharge to surface water. These wastes would then be evaporated and dried over time.

Other potential surface-water impacts could occur from leaking fuel or lubricants from heavy construction equipment and passenger vehicles that would be operated during the construction phase of the Proposed Action. Any such leaks of equipment fluids would be mitigated by the Applicant locating construction activities away from surface-water features, when possible, and rapidly responding to leaks by properly sealing the equipment as needed and by containing and cleaning up the leakage.

Stream channels within the Ross Project would be potentially impacted when crossed by roads, pipelines, and utilities. The Applicant estimates that three stream-channel crossings would be constructed and one existing stream-channel crossing would need to be rehabilitated during the construction phase of the Proposed Action. In addition, there are several instances where tertiary roads would access wellfields and would cross ephemeral drainages. To mitigate impacts, these channel crossings would consist of unconstructed, two-track roads that would be constructed away from drainages where possible; ephemeral channel crossings would involve minimal land disturbance, and they would not be used during flow events. In the instances where it is necessary to cross a stream channel, the crossing would be made perpendicular to the channel and would include a culvert capable of passing the runoff resulting from a 10-year, 24-hour precipitation event. Sediment load would be mitigated by sediment-control BMPs. Pipeline crossings would be constructed in the same corridor as road crossings where possible to minimize disturbance. The impacts to surface-water flow from construction activities across a stream channel would also be minimized by the Applicant routing flow around active construction activities, storing the water in temporary sediment surface impoundments, or passing the water through sediment-control measures prior to discharge (Strata, 2011a). Given the site-specific mitigation measures to be implemented by the Applicant, the potential impacts of the Proposed Action's construction to surface-water quality would be SMALL.

The Applicant has applied for a permit with the U.S. Army Corps of Engineers (USACE) through USACE's Section 404 of the *Clean Water Act* (CWA) permitting process that, if granted, would authorize dredge and fill activities and require the Applicant to mitigate the disturbance of wetlands. While the impacts to surface water could have MODERATE impacts before mitigation (NRC, 2009), the Section 404 permit would establish conditions that could mitigate such impacts. The Applicant anticipates that it would be required to operate in accordance with a Nationwide Permit (NWP) for specific construction activities.

The Ross Project area hosts approximately 26 ha [65 ac] of potential wetlands mostly situated along the Little Missouri River and adjacent to the Oshoto Reservoir (Strata, 2011a). Construction of the Proposed Action would have the potential to impact up to 0.8 ha [2 ac] of wetlands. Prior to disturbing any USACE-verified wetlands, the Applicant would apply for coverage under a USACE permit for specific construction activities such as pipeline installation and access-road stream-channel crossings. For example, the Permit application would require the Applicant to provide a site-specific mitigation plan for construction-related disturbance of jurisdictional wetlands (i.e., wetlands regulated by the USACE under Section 404 of the CWA).

Depending upon the nature of the anticipated wetlands disturbance, mitigation could include the Applicant re-establishing temporarily disturbed wetlands in place, enhancing other existing wetlands, or constructing additional wetland areas for circumstances where the disturbance would be long term. Mitigation measures would ensure that the Proposed Action does not result in a net loss of wetlands. Thus, while the impacts to wetlands could have MODERATE impacts before mitigation (NRC, 2009), a USACE CWA permit would establish conditions that could mitigate such impacts to wetlands. The potential impacts of the Proposed Action's construction to wetlands consequently would be SMALL.

Ground Water

As stated in GEIS Section 4.2.4 and 4.4.4, potential impacts to ground water during an ISR facility's construction are primarily from consumptive water use and contamination caused by: drilling fluids and muds during injection, recovery, and monitoring well drilling; and fuel and lubricant spills and leaks from construction equipment. It is further noted in the GEIS that ground-water use during an ISR facility's construction phase would be limited, and that ground water would be protected by implementing BMPs such as spill-prevention and spill-cleanup protocols. A limited amount of drilling fluids and muds would be introduced into the environment during well installation. Because of the limited nature of construction activities and the implementation of BMPs to protect shallow ground water, the GEIS concluded that construction impacts on ground water would be SMALL (NRC, 2009).

Although construction of the CBW during the Proposed Action is not part of the typical ISR design considered in the GEIS, the analysis of impacts to ground water provided in the GEIS are applicable because the effects of the CBW on shallow ground water are localized and the presence of the CBW would not affect the surrounding ground water.

In the following sections, potential impacts and mitigation measures are considered for three aquifer units: 1) The unconfined shallow (near-surface) aquifers; 2) the confined aquifers hosting the ore-zone (OZ) as well as those above and below the ore zone (the shallow-monitoring [SM] and the deep-monitoring [DM]); and 3) the deeper aquifers below the DM aquifer.

Shallow Aquifers

Potential impacts to the quantity of water in the shallow aquifers during construction of the Proposed Action would be caused by the quantity taken from the Oshoto Reservoir and the quantity involved in the installation of the CBW surrounding the facility (i.e., the CPP and surface impoundments). In the vicinity of the Oshoto Reservoir, the Reservoir stage (i.e., the volume of water it contains) and the shallow-aquifers water levels are closely related (Strata, 2012b). Although the Applicant anticipates an annual withdrawal of 4.6 ha-m/yr [37 ac-ft/yr] of water during construction, that volume is less than the permitted annual appropriation for the Oshoto Reservoir, 21 ha-m/yr [173 ac-ft/yr] (Strata, 2012b). Any changes in ground-water levels due to water usage from Oshoto Reservoir would be small and restricted to the area around the Reservoir.

Construction of the CBW (see SEIS Section 2.1.1.1) could impact the quantity of water in the shallow aquifer because the CBW would isolate the shallow aquifer at the Ross Project facility. Preconstruction dewatering within the facility's area would lower water levels locally in the shallow aquifer, but the normal ground-water flow regime would not be disrupted. The Applicant anticipates that the construction dewatering following installation of the CBW would be a one-time event and require little continuing maintenance. Ground-water use would be mitigated by the design of the CBW, which would prevent any leakage inside the CBW that would require removal by pumping. Thus, the potential impacts from the construction of the Proposed Action to ground-water quantity in the shallow aquifers would be SMALL.
In addition, shallow-aquifer water levels could increase slightly on the hydraulically up-gradient side of the CBW and could decrease slightly on the hydraulically down-gradient side of the CBW in response to the lower permeability of the CBW relative to the shallow aquifer. The changes in ground-water levels would be restricted to the area adjacent to the CBW (Strata, 2011a).

Potential water-quality impacts to the shallow aquifer that could occur during construction include spills or leaks from construction equipment and the introduction of drilling fluids. The potential for the shallow ground water to be impacted by drilling fluids and muds is minimal because of the small volume of fluids used, and because the fluids would be contained within a mud pit in accordance with WDEQ/LQD and EPA requirements. Impacts to ground water during well drilling would be further limited by the nature of the bentonite or polymer-based drilling additives in the drilling fluids. These additives are designed to limit infiltration in an aquifer (i.e., to a few inches) and to isolate the drillhole from the surrounding geologic materials via a wall-cake or veneer of drilling-fluid filtrate, further diminishing the potential for impacts. Thus, the potential impacts of the Proposed Action's construction to ground-water quality in the shallow aquifers would be SMALL.

Ore-Zone and Surrounding Aquifers

Ground water used for domestic uses and agricultural irrigation during the Proposed Action's construction is estimated to be 3.8 L/min [1.0 gal/min] (see Table 4.3). A water-supply well drawing water from the SM aquifer would be used to supply these needs. Based upon yields from regional baseline wells and other wells completed in the SM aquifer, ground-water modeling indicates that the aquifer could support this level of withdrawal with little drawdown (Strata, 2011b). The potential impacts of the Proposed Action's construction on the ground-water quantity available from the confined aquifers, therefore, would be SMALL.

Drilling for mineral delineation and well installation would potentially impact the SM aquifer, the OZ aquifer laterally adjacent to the ore zone, and the DM aquifer. Improperly abandoned drillholes, overly penetrating drillholes, or lack of well integrity could result in the mixing of industrial-use ground water from the OZ aquifer with the chloride-dominated ground water of the DM aquifer or the stock-water quality of the overlying SM aquifer. This mixing would be localized and any significant changes in water quality would be detected by monitoring wells.

To mitigate potential impacts to the confined aquifers from drilling, the Applicant proposes to continue to comply with WDEQ/LQD rules for well completion and drillhole abandonment (WDEQ/LQD, 2005). The Applicant would rely upon the geological model developed to determine total depths for drill holes, thus preventing over-penetration into underlying aquifers. Onsite geological and engineering supervision would continue throughout the construction phase. Wells installed for further hydrologic studies, pre-licensing baseline site characterization, and production infrastructure would pass mechanical integrity testing (MIT) prior to use (see SEIS Section 2.1.1). Consequently, the potential impacts from the Proposed Action's construction on the ground-water quality within the confined aquifers would be SMALL.

Deep Aquifers

Construction of the Ross Project would not impact the aquifers below the DM aquifer. The Flathead and Deadwood Formations would be tapped by the construction of the Class I injection well(s) discussed in SEIS Section 2.1.1, where that well(s) would be used for the disposal of brine and other byproduct liquid wastes during the Ross Project's operation, aquifer restoration, and decommissioning phases. The potential impacts of construction of the Proposed Action on the quantity and quality of ground water present within the deep aquifers would be SMALL.

4.5.1.2 Ross Project Operation

This section describes potential impacts and mitigation measures to surface and ground waters associated with operation of the Proposed Action.

<u>Surface Water and Wetlands</u>

As described in GEIS Sections 4.2.4 and 4.4.4, surface waters could be impacted by accidental spills during ISR operations. Spills from the CPP or wellfields as well as spills during transportation could impact storm-water runoff or contaminate shallow aquifers that are hydraulically connected to surface waters. The GEIS determined that surface-water monitoring and spill response would limit the impacts of potential surface spills to SMALL; however, impacts of spills to surface waters that are connected to shallow aquifers would be SMALL to MODERATE, depending upon the specifics of an incident. Activities posing potential impacts to surface waters from uranium-recovery operation would be regulated by Federal agencies. According to the GEIS, the Applicant's use of BMPs, and implementation of required mitigation measures would moderate the impacts of the Proposed Action's operation from MODERATE to SMALL, depending upon local conditions.

The Applicant estimates that approximately 45 L/min [12 gal/min] of surface water from either the Oshoto Reservoir or the Little Missouri River would be used during the Proposed Action's operation for continuing construction activities in the wellfields and for dust control (see Table 4.3). The estimated annual use of 2.4 ha-m [19 ac-ft/yr] would be significantly less than the existing, permitted annual appropriation for Oshoto Reservoir of 21 ha-m [173 ac-ft/yr]. Ground water produced from monitoring and testing wells outside the exempt (ore-zone or OZ) aquifer would be discharged according to a temporary WYPDES Permit, comparable to the permit obtained by the Applicant for development of its monitoring wells installed in 2010. This water would either infiltrate into the ground or add to the surface water in the Little Missouri River.

Flow in the Little Missouri River could potentially be affected during operation. Water from the Little Missouri River infiltrates into the OZ aquifer where the Fox Hills and Lance Formations outcrop at the ground surface east of the Ross Project area (Strata, 2011a). The Applicant's ground-water model shows that infiltration would increase by approximately 6 L/min [1.5 gal/min], decreasing the average annual discharge of the Little Missouri River by less than 0.005 percent just downstream of the Wyoming-Montana border (Strata, 2011a). Thus, no mitigation measures would be warranted for this very small volume and the potential impacts of the Proposed Action's operation on surface-water quantity would be SMALL.

Storm-water runoff from impervious surfaces, including buildings, roads, and parking areas, could result in higher water flows, channel erosion, and increased sediment concentrations in surface waters. The Applicant predicts a peak flow of 1.4 m^3/s [50 ft^3/s] during a 100-year, 24-hour storm (Strata, 2011a). This peak flow represents an increase of less than 1 percent of the peak flow in the Little Missouri River of 170 m^3/s [6,000 ft^3/s]. In addition, BMPs would be implemented by the Applicant to reduce erosion and the likelihood of increased sediment loads.

Surface-water runoff would be mitigated by the Proposed Action's storm-water control system that would route all storm water to a sediment surface impoundment sized to hold runoff from the 100-year, 24-hour runoff event. A flood-control diversion channel around the CPP and surface impoundments (i.e., the facility itself) would prevent storm water originating in the ephemeral stream channel upstream of the facility from encountering process solutions or chemicals. Mitigation measures employed by the Applicant to reduce soil erosion would also mitigate storm-water runoff across the Ross Project. Protection of wellheads and module buildings from large runoff events would typically be accomplished by placement on high ground out of the flood plain. When wells or other facility components must be placed within the 100-year-flood inundation area, appropriate engineering controls would be used to ensure safety and environmental protection. The injection, recovery, and monitoring wells would be protected from flooding by the installation of cement seals around the well casings and the use of watertight well caps.

Measures designed to mitigate the impacts from suspended sediment would be contained in the WYPDES Storm-Water Permit required by the Applicant prior to uranium-recovery operation. The Permit would include a SWPPP that describes erosion and sediment controls as well as operational controls that would be used to ensure that storm-water discharges from the Ross Project facility do not cause a violation of Wyoming's surface-water quality standards (WDEQ/WQD, 2007). Storm-water BMPs would be inspected semiannually or as required by the WYPDES Storm-Water Permit. The SWPPP would be updated as needed, such as when potential problems are identified during inspections or when there are changes in uranium-recovery operation (e.g., transition from operation to aquifer restoration). The WYPDES Storm-Water Permit would also require storm-water discharge sampling and analysis as well as compliance with a numeric effluent limit for total suspended sediment.

Release of process solutions from uranium-recovery wellheads, pipelines, module buildings, or process vessels; accidental discharge from surface impoundments; or release of yellowcake or IX resin during a transportation accident could result in surface-water contamination if the release(s) reached a surface-water body. Impacts from releases that do reach surface water(s) would be short-term, elevated concentrations of radionuclides and associated chemical constituents at levels above post-licensing, pre-operational baseline conditions. Cleanup of contaminated sediments associated with a spill would follow the same requirements as those for soil cleanup efforts (see SEIS Section 4.4.1.2). Any impacts to surface waters would decline over time as the contaminated fluids are dispersed in the surface-water body.

The potential for release of process solutions would be mitigated by the control system in place at the Ross Project which continually monitors pressure and flow. Accidental discharge from surface impoundments would be mitigated by the size and design of the impoundments and by regular inspections. Because roads would cross surface-water drainages in only a few, isolated locations, it is unlikely that a transportation accident would result in a release to any surface water. Further mitigation of impacts would be accomplished by Applicant's personnel containing and cleaning up any release before the solution could migrate to a surface-water body. Therefore, given these mitigation measures, the potential impacts of the operation of the Proposed Action on surface-water quality would be SMALL.

The potential impacts of the Proposed Action's operation to the Ross Project area's wetlands would be the same as described for the Ross Project's construction-phase impacts and the impacts would be SMALL.

Ground Water

The GEIS concluded in GEIS Sections 4.2.4 and 4.4.4 that the amounts of ground water used in routine activities such as dust suppression, cement mixing, and well drilling are small and would have a SMALL and temporary impact.

At an ISR facility, a network of buried pipelines would be used during in situ uranium recovery for transporting lixiviant between pump houses and the CPP as well as connecting injection and extraction wells to manifolds inside the header houses. The failure of pipeline fittings or valves, or well mechanical-integrity failures, in shallow aquifers could result in spills or leaks of lixiviant, which could impact water quality in the shallow aquifers. Potential environmental impacts due to spills and leaks from pipelines could be MODERATE to LARGE depending upon site-specific conditions, including whether 1) the ground water in the shallow aquifers is close to the ground surface; 2) the shallow aquifers are important sources for local domestic or agricultural water supplies; or 3) the shallow aquifers are hydraulically connected to other locally or regionally important aquifers; or 4) the shallow aquifers have either poor water quality or yields that are not economically suitable for production (NRC, 2009). The use of surface impoundments to manage process solutions generated during ISR activities could also impact shallow aquifers by failure of impoundment embankments or their liners. Potential impacts of such failures would be expected to be minimized as stated in the NRC license, where requirements such as installation of leak-detection systems, maintenance of reserve capacity, and embankment inspections would be required. Thus, the GEIS concluded that impacts of the use of surface impoundments on ground water would be SMALL (NRC, 2009).

As discussed in GEIS Sections 4.2.4 and 4.4.4, potential environmental impacts to ground-water resources in the OZ and surrounding aquifers include consumptive water use and changes to water quality (NRC, 2009). Consumptive use arises from the fact that ISR operations withdraw about 2 percent more water than is injected into the wellfields, which is referred to as “production bleed.” Ground-water bleed ensures a net inflow of ground water into the wellfield to minimize the potential movement of lixiviant and its associated contaminants out of the wellfield. Bleed water is generally disposed of through a waste-water control system, and it is not re-injected into the ISR wellfields. The GEIS determined that the short-term impacts of consumptive use could be MODERATE, but temporary, if the OZ aquifer outside the exempted portion of ore zone is used locally. (Uranium-recovery requires exemption of the uranium-bearing aquifer as an underground source of drinking water and is exempted through Wyoming’s UIC program administered by the WDEQ.). Therefore, the long-term consumptive-use impacts would be expected to be SMALL in most cases, depending on site-specific conditions.

The GEIS noted that water quality in the OZ aquifer would be degraded during ISR operations (NRC, 2009). A licensee would be required, by its WDEQ Permit to Mine and would be by its NRC license, to initiate aquifer-restoration activities to restore the OZ aquifer to preoperational conditions, if possible. If the aquifer cannot be returned to post-licensing, pre-operational conditions described in SEIS Section 2.1.1.1, the NRC would require that the aquifer meet the U.S. Environmental Protection Agency (EPA) maximum contaminant levels (MCLs) provided in 10 CFR Part 40, Appendix A, Table 5C or Alternate Concentration Limits (ACLs), as approved by NRC (10 CFR Part 40; NRC, 2009b). For these reasons, the NRC determined in the GEIS that potential impacts to water quality of the uranium-bearing aquifer (i.e., ore zone, production zone or unit, or mineralized zone) as a result of ISR operations would be expected to be SMALL and temporary (NRC, 2009).

In GEIS Section 4.2.4 as cited by GEIS Section 4.4.4, the potential for vertical and horizontal excursions of degraded ground water outside of the uranium-production zone (i.e., the ore zone) is discussed. The impact of horizontal excursions could be MODERATE or LARGE, if a large volume of contaminated water leaves the ore zone and moves down-gradient and impacts an area outside the ore zone which is being used for consumption (NRC, 2009). The historical record for several licensed ISR facilities indicates that excursions occur at ISR operations (NRC, 2009). Most of the excursions are horizontal and were recovered within months after detection. Vertical excursions tend to be more difficult to recover than horizontal excursions, and in a few cases, remained on excursion status for as long as eight years. The vertical excursions were traced to thinning of the confining geologic interval below the ore zone and improperly abandoned drillholes from earlier exploration activities (NRC, 2009).

To reduce the likelihood and consequences of potential excursions, the NRC requires licensees to identify preventive measures before starting ISR operations. In general, the potential impacts of vertical excursions to ground-water quality in surrounding aquifers would be SMALL if the vertical hydraulic-head gradients between the OZ aquifer and the adjacent aquifer are small; if the vertical hydraulic conductivities of the confining geologic units are low; and if the confining geologic units are sufficiently thick (NRC, 2009). Environmental impacts, however, would be expected to be MODERATE or LARGE if the confining units are discontinuous, thin, or fractured (NRC, 2009). The NRC requires assurance of the integrity of the confining units to minimize the potential impacts from horizontal excursions.

As indicated in GEIS Sections 4.2.4.2.2.3 and 4.4.4.2.2.3, the potential environmental impacts from disposal of liquid effluents into deep aquifers below ore-bearing aquifers would be SMALL, if water production from the deep aquifers is not economically feasible; if the ground-water quality from these aquifers is not suitable for domestic or agricultural uses (e.g., high salinity); and if they are confined above by sufficiently thick and continuous low-permeability layers (NRC, 2009). Under different environmental laws such as the CWA, the *Safe Drinking Water Act*, and the *Clean Air Act* (CAA), the EPA has statutory authority to regulate activities that could affect the environment. Underground injection of liquids requires a permit from the EPA or from an authorized State UIC program. As noted in SEIS Section 2.1, the WDEQ has been authorized to administer the UIC program in Wyoming.

In the following sections, the potential impacts and mitigation measures related to the Proposed Action's operation are considered for the three types of aquifers: 1) the unconfined shallow (i.e., near-surface) aquifers; 2) the confined aquifers hosting the ore zone as well as those above and below the ore zone (the SM and the DM aquifers); and 3) the deep aquifers below the DM aquifer.

Shallow Aquifers

Potential impacts from operation to ground-water quantity in the shallow aquifers would be similar to those described for the Proposed Action's construction phase and would be SMALL.

During ISR operation, the water quality throughout the Ross Project has the potential to be impacted by accidental spills or leaks from chemical-storage areas, process-solution vessels, or the surface impoundments as well as by spills and leaks of lixiviant from failure of a pipeline or a shallow break in the casing of an injection or recovery well. To reduce the risk of pipeline failure, the Applicant would hydrostatically test all pipelines prior to use and install leak-detection devices in manholes along the pipelines. The Applicant's implementation of BMPs during Ross Project operation would reduce the likelihood and magnitude of spills or leaks and facilitate expeditious cleanup.

Further, the Applicant would monitor recovery and injection pipelines and immediately shut down affected pumps if a spill or leak were detected (Strata, 2011b). The CPP would include a control room where a master control-system would allow remote monitoring and control of ISR, wellfield, and deep-well-disposal operations (Strata, 2011b). Operators would be located in the CPP's control room 24 hours a day and would use a computer-based station to command the control system.

MIT would be conducted on all Class III injection wells, recovery wells, and monitoring wells (see SEIS Section 2.1.1). Construction of all wells and their respective MIT would comply with the pertinent WDEQ/LQD regulations (WDEQ/LQD, 2005).

The Applicant would also implement spill control, containment, and cleanup measures in the CPP and surface-impoundment areas (i.e., the facility). These measures would include secondary containment for process-solution vessels and chemical storage tanks, a geosynthetic liner beneath the CPP's foundation, dual liners with a leak-detection system for the surface impoundments, and a sediment impoundment to capture storm-water runoff. In the event of a surface-impoundment leak, sufficient capacity would be reserved in the other impoundments' cells to allow the contents of the leaking cell to be rapidly transferred, minimizing the volume of the release. In addition, the ground-water levels within the CBW would be maintained below the ground-water levels in the shallow aquifer outside the CBW. This would impose inward and upward hydraulic gradients and therefore minimize the potential for contaminated ground water to migrate into the regional system. Thus, the potential impacts of the Proposed Action's operation to ground-water quality in the shallow aquifers would be SMALL.

Ore-Zone and Surrounding Aquifers

Potential impacts from the consumptive use of ground water from the ore-zone and surrounding aquifers were evaluated by the Applicant using a regional numerical model (Strata, 2011b). The conditions simulated by the Applicant were for two ISR "mine units" operating simultaneously, as described in SEIS Section 2.1.1. Details of the ISR simulations and results of the modeling are provided in Addendum 2.7-H of the Applicant's TR (Strata, 2011b).

During the production simulation, each wellfield module was estimated to operate at a maximum rate of 44 L/s [700 gal/m] or 1.10 L/s [17.5 gal/m] per well. Estimated bleed rate during production was estimated at 1.25 percent (0.55 L/s [8.75 gal/m] per module, 0.0138 L/s [0.219 gal/m] per recovery well). The ground-water sweep operation was estimated to remove 50 percent of the pore volume of the wellfield (see SEIS Section 2.1.1.2). Based upon the three-month sweep period, the estimated flow rate during sweep was 0.0827 L/s [1.31 gal/m] per recovery well. Aquifer-restoration activities were assumed to last approximately six months (actual time could vary based upon wellfield conditions). The bleed during restoration would be expected to vary depending upon whether or not aquifer restoration is occurring concurrent with uranium recovery in other wellfields. When restoration is occurring in one wellfield and uranium recovery is simultaneously occurring in another wellfield, excess bleed from the well undergoing uranium recovery would be used to offset reverse-osmosis (RO) losses within the wellfield in restoration.

The simulations assumed no changes in flow rates within the stock and domestic wells within the model area. Estimated flow rates for the oil-field water-supply wells were developed based upon average historical flow rates for the last two years of recorded flow (2008 and 2009). Three of the oil-field water-supply wells (Nos. 22X-19, 19XX, and 789V) are located immediately adjacent to Modules 2-6 and 2-7. The Applicant has been in communication with Merit, the owner of these wells, and is currently exploring alternative water sources that would allow it to suspend use of the wells before and during uranium recovery. Currently, the goal is to have the Merit wells shut off approximately two years prior to uranium recovery. Given the uncertainty associated with the future status of the Merit wells, the Applicant simulated two uranium-recovery scenarios. Scenario 1 assumed that an alternative water supply could be found, allowing the Merit wells to be taken out of operation two years prior to uranium recovery, and kept out of operation until recovery operations cease. Scenario 2 assumed that an alternative water supply source could not be located and that, during uranium-recovery operation, the Merit oil-field water-supply wells operated at the assumed 2008 – 2009 average flow rates.

The maximum modeled drawdowns for select wells in the OZ aquifer, within and adjacent to the Ross Project area, at the end of uranium-recovery operation and aquifer restoration for the two scenarios are presented in Addendum 2.7-H of the Applicant's TR (Strata, 2011b). The most significant estimated drawdown occurs in the Wesley No. TW02 well located in the SWSW Section 8, Township 53 North, Range 67 West, with 10.2 m [33.3 ft] of drawdown or 42.4 percent of the available head under Scenario 2 at the end of aquifer restoration. This well supplies water to a structure that is currently used by the Applicant as its Field Office for the Ross Project and to provide water to livestock.

Potential impacts to the SM-aquifer water quantity, because of withdrawals during uranium recovery and aquifer restoration in the ore zone, were also evaluated by the regional ground-water model (Strata, 2011b). Under the two recovery scenarios evaluated, the estimated maximum amounts of drawdown ranged from 1.5 – 5 m [5 – 15 ft] within the Ross Project area following the Proposed Action's operation and aquifer-restoration phases.

Impacts from consumptive use of ground water from the ore zone would be minimized by cessation of water withdrawals by the Merit oil-field water-supply wells. The ground-water model simulated a single operational sequence of wellfield development, recovery, and aquifer restoration. Different operational approaches could be more effective in reducing impacts, and the Applicant proposes to investigate these as wellfield installation and testing progresses.

In the event that uranium recovery at the Proposed Action prevents the full use of a well which provides water under a valid water right, the Applicant would commit to providing an alternative source of water of equal or better quality and quantity, subject to Wyoming water statute requirements.

In the regional numerical model, the model's lower boundary was the base of the ore zone/top of the lower confining unit. As a result, potential impacts to the DM aquifer were not evaluated by the model. The DM aquifer supports only one well (Merit Well No. 22X-19), and it has only limited hydraulic conductivity and yield. Thus, as the model demonstrates, the potential impacts from the Proposed Action's operation to ground-water quantity in the confined aquifers would be SMALL.

There is potential for water-quality impacts (vertical excursions) to the SM and DM aquifers from the lixiviant-fortified ground water during injection and withdrawal from the OZ aquifer, although this potential is mitigated by the natural confining units of fine-grained mudstones, siltstones, and claystones above and below the OZ aquifer (see SEIS Section 3.5).

The Applicant tested the integrity of the lower confining unit separating the OZ aquifer from the DM aquifer with a six pump tests; in two of the six tests, pumping of the OZ aquifer showed a possible response in the DM aquifer (Strata, 2011a). These responses were interpreted by the Applicant as due to improperly plugged previous exploration drillholes that have not yet been properly abandoned. Other aquifer tests by Nubeth and the Applicant recorded no response in the aquifers vertically adjacent to the ore zone. Different water qualities, observed in the OZ and DM aquifers also support the premise of hydraulic separation. Stratigraphic sections created by the Applicant from the geologic logs of the drillholes have provided further support for the continuity and integrity of the shale confining units (Strata, 2011b). The thickness of the shale unit between the OZ and the DM aquifers is generally greater than 6 m [20 ft], except for an area along the southern edge of the Ross Project area where the unit thins to about 1.5 m [5 ft]. The Applicant would continue geologic evaluation and hydrologic testing to characterize the integrity of the lower confining unit, through observations of piezometric levels in the SM and DM aquifers.

The Applicant would implement a WDEQ-approved MIT program for all injection and recovery wells to ensure casing integrity (WDEQ/LQD, 2005). Breaches to the integrity of the confining unit from old exploration drillholes would be minimized by the Applicant locating the drillholes within the wellfields and beneath the Proposed Action as well as plugging and abandoning them with low-hydraulic-conductivity materials such as cement or heavily mixed bentonite grout according to methods approved by WDEQ as described in Section 2 of this SEIS (Strata, 2011b). As of October 2010, the Applicant had located 759 of the 1,682 holes from Nubeth exploration activities and had plugged 55 of them (Strata, 2011b). The Applicant proposes to actively locate and plug all exploration drillholes prior to beginning wellfield operation.

If the Ross Project were to be licensed by the NRC, the NRC license would include a requirement that the Applicant install a ring of monitoring wells around each wellfield. The wells would allow monitoring of the SM and DM aquifers as well as the OZ aquifer around their perimeters. The ground-water model discussed in SEIS Section 3.5.3, Local Ground-Water Resources, indicates that a spacing of 122 –183 m [400 – 600 ft] between the production wellfields and perimeter monitoring-well ring would be sufficient to detect an excursion; thus, spacing between the monitoring wells is also proposed to be 122 –183 m [400 – 600 ft] (Strata, 2011b). The simulations indicated that a head change or hydraulic anomaly would rapidly become apparent in the perimeter wells before any geochemical changes in the ground water would be detected. The NRC would require an early-warning system of pressure transducers to detect anomalous hydrostatic pressure increases in the perimeter monitoring wells and sampling of monitoring wells with a semi-monthly frequency. Mitigation in the event of a vertical excursion of lixiviant-containing ground water to the SM or DM aquifers could require withdrawal and treatment of contaminated ground water from these aquifers.

During the Proposed Action’s operation, the ground-water quality in the OZ aquifer would be impacted during uranium-recovery operation. The Applicant proposes to file an exemption request with WDEQ/LQD for exemption of the OZ aquifer as a source of drinking water based upon the fact that some constituents in the ground water (e.g., TDS, sulfate, ammonia, radium-226+228, and gross alpha) currently exceed applicable standards for human or livestock water consumption as shown in Tables 3.6, 3.7, and 3.8 and in SEIS Section 3.5.3 (Strata, 2011b). The uranium and vanadium in the ore zone would be oxidized and mobilized by the introduction of lixiviant into the OZ aquifer through injection wells. In addition to the uranium and vanadium, other constituents would also be mobilized, including anions, cations, and trace metals (Strata, 2011b). These impacts to the water quality of OZ aquifer within the wellfields would be short-term because aquifer restoration would be required by the NRC license to return these constituent concentrations to each wellfield’s respective NRC-approved baseline (i.e., post-licensing, pre-operational) concentrations, or ACLs as approved by the NRC.

The quality of the non-exempted OZ aquifer outside the perimeter monitoring-well rings could be impacted via a lateral excursion resulting from a local wellfield imbalance. A wellfield imbalance occurs when the rate of injected lixiviant exceeds the rate of extraction by the recovery wells, resulting in a migration of lixiviant laterally away from the wellfield. The Applicant proposes a computer-based control system, staffed 24 hours a day within the CPP, to monitor injection pressures and recovery-well flow rates so that wellfield balance would be maintained (Strata, 2011a).

In the event of an operational upset, the ground-water model, integrated with injection and recovery well data, would allow for a determination of potential migration paths and assist the system's operator in making decisions on mitigating actions. The Applicant notes that the heterogeneous lithology of the sandstones produces lateral and vertical variations in permeability, with uranium mineralization concentrated in the higher-permeability sediments. Lateral migration of lixiviant would therefore be limited by the less-permeable and un-mineralized zones within the ore-zone sandstones.

Temporary impacts to water quality would result if an excursion were to occur. Typical lixiviant circulating through the ore zone would contain high concentrations of sodium, bicarbonate, chloride, and sulfate with TDS up to 12,000 mg/L and concentrations of uranium, vanadium, and radium greater than 100 mg/L (NRC, 2009; Strata, 2011a; WDEQ/WQD, 2011). As described in SEIS Section 3.5, the water qualities in the surrounding aquifers have much lower TDS, averaging 1,092 mg/L, 1,600 mg/L, and 1,268 mg/L in the SM, OZ, and DM aquifers, respectively, or about 10 percent of the TDS of the lixiviant. Preconstruction monitoring by the Applicant has shown concentrations of uranium (less than 0.004 mg/L]) and radium (less than 0.01 Bq/L [0.4 pCi/L]) in the SM and DM aquifers (Strata, 2011a). Higher concentrations of uranium (maximum value of 0.109 mg/L) and radium (maximum value of 0.44 Bq/L [12.01 pCi/L]) were measured in the ore zone (Strata, 2011a). Temporary impacts to water quality from an excursion of increased concentrations of TDS, uranium, radium, and other radionuclides as well as elements such as arsenic, selenium, and vanadium that are mobilized with the uranium would be expected.

The potential impacts of the operation of the Proposed Action to ground-water quality in the confined aquifers above and below the ore zone would, therefore, be SMALL. The short-term potential impacts of lixiviant excursions from uranium-recovery operation to the OZ aquifer outside the exempted area would be SMALL to MODERATE. Detection of excursions through the network of monitoring wells, followed by the Applicant's pumping of ground water to recover the excursion would reduce long-term potential impacts to the OZ aquifer outside the exempted portion to SMALL.

Deep Aquifers

The Applicant plans to dispose of brine and other liquid byproduct wastes into five deep wells discharging into the Flathead and Deadwood Formations, which are defined as the Formations that occur beneath the base of the Icebox Shale member of the Winnipeg Group and above the top of the Precambrian basement. There are no porous and permeable zones below the Deadwood and Flathead Formations that would make suitable injection zones. Because of the depth in the stratigraphic column at which these Formations occur and the apparent lack of oil or other hydrocarbons, there has been little exploration of these intervals and few data are available for the Ross Project area. To improve its understanding of the targeted Formations, the Applicant plans to drill one deep well for hydraulic testing as a preconstruction activity (Strata, 2011a). If the capacity in the targeted Formation for injected solutions is less than anticipated by the Applicant, more wells than five may be needed.

The UIC Class I Permit issued by the WDEQ identified the confining unit immediately above the discharge zone as consisting of approximately 16 m [52 ft] of Icebox Shale. An additional confining unit immediately above the Icebox Shale is the Red River Formation, which consists of 97 – 140 m [318 – 460 ft] of cryptocrystalline to microcrystalline impermeable dolomite. The top of the discharge zone occurs about 2,488 m [8,163 ft] below the ground surface, and the total thickness of the injection zone for the wells is estimated to be 180 m [592 ft]. In issuing the UIC Permit, the WDEQ/WQD determined that, at the depths and locations of the injection zones specified in the Permit, the use of ground water from the Flathead and Deadwood Formations is economically and technologically impractical (WDEQ/WQD, 2011).

The data that are available for the Formations targeted for deep-well injection suggest that ground water contains greater than 10,000 mg/L TDS. The estimated water quality of the brine, one liquid effluent that would be injected in the deep-injection wells, comprises the following constituent concentrations: 4,000 – 40,000 mg/L TDS; 5 – 25 mg/L uranium as U_3O_8; and 14.8 – 92.5 Bq/L [400 – 2,500 pCi/L] Ra-226. Its pH is between 6 and 9. WDEQ concluded that the liquid effluents could be suitably isolated in the deep aquifers, and they would not affect any overlying underground sources of drinking water. The deep-injection wells would be installed and tested in accordance with WDEQ/WQD Class I disposal-well standards and the UIC Permit. The Permit requires the Applicant to control effluent pressures at the wellhead to ensure that the fracture pressure of the Formation is not exceeded. Regular monitoring of the water quality of the injected brine is required by the Permit, and pH would have to meet the respective upper control limits (UCLs) to be injected (WDEQ/WQD, 2011). The Permit also prohibits injection of hazardous waste as defined by EPA and WDEQ. Thus, the potential impacts of the Proposed Action's operation to ground-water quantity and quality in the deep aquifers would be SMALL. The conditions of the UIC Permit would mitigate potential impacts, including those described above.

4.5.1.3 Ross Project Aquifer Restoration

The Proposed Action's aquifer-restoration methodology would use a combination and sequence of: 1) ground-water transfer; 2) ground-water sweep; 3) reverse osmosis (RO), permeate injection, and recirculation; (4) stabilization; and (5) water treatment and surface conveyance. The Applicant proposes to use ground-water sweep selectively (i.e., around the perimeter of the wellfield) rather than throughout the entire wellfield to minimize the consumptive use of ground water (Strata, 2011a). After the first wellfield is depleted, the Applicant would conduct aquifer restoration concurrently with operation of subsequent wellfields. Consumptive use of ground water during the aquifer-restoration phase is generally greater than during uranium-recovery operation (NRC, 2009).

Surface Water

As described in GEIS Sections 4.2.4.1.3 and 4.4.4.1.3, the activities occurring during aquifer restoration that could impact surface waters include management of waste water, permeate reinjection, storm-water runoff, and accidental spills and leaks (NRC, 2009). The GEIS concluded that the potential impacts to surface water due to the management of ground water extracted during aquifer restoration would be SMALL. An ISR operator's compliance with permit conditions, use of BMPs, and execution of mitigation measures would reduce impacts from storm-water runoff as well as accidental spills and leaks such that they would be SMALL to MODERATE, depending upon site-specific conditions.

At the Ross Project, the Applicant intends to use approximately 13.6 L/min [3.6 gal/min] of water obtained from either the Oshoto Reservoir or the Little Missouri River for dust control during aquifer restoration (see Table 4.3). The potential impacts would thus be comparable to those during the Proposed Action's construction and operation phases.

Potential increases in sediment concentrations during the Proposed Action's aquifer-restoration phase would also be comparable to its operation phase. Potential risk of surface-water contamination associated with releases of process solutions and/or waste liquids as well as spills of other materials during aquifer restoration would be comparable to the operation phase of the Proposed Action, although the concentration of uranium-bearing solutions would decline. Thus, the potential impacts of aquifer restoration to surface-water quantity and quality would be SMALL.

The potential impacts of aquifer restoration during the Proposed Action to the wetlands on the Ross Project area would be the same as discussed under the Ross Project's construction.

Ground Water

As the GEIS states in Sections 4.2.4 and 4.4.4, the potential environmental impacts on ground-water resources during aquifer restoration are related to ground-water consumptive use and waste-management practices, including liquid-effluent discharges to the surface impoundments and deep disposal of brine resulting from the RO process. In addition, aquifer restoration directly affects ground-water quality in the vicinity of the wellfield being restored (NRC, 2009). The purpose of aquifer restoration is to return the ground-water quality in the production zone (i.e., the exempted ore zone) to ground-water protection standards specified at 10 CFR Part 40, Appendix A. These standards require that the concentration of a given hazardous constituent must not exceed 1) the NRC-approved background concentration of that constituent in ground water, 2) the respective numeric value in the table included in Paragraph 5C, if the specific constituent is listed in the table and if the background level of the constituent is below the value listed, or 3) an ACL the NRC establishes for the constituent. Potential impacts are affected by the aquifer-restoration methodologies chosen, the respective severity and extent of the contamination, and the current and future uses of the ore-zone and surrounding aquifers in the vicinity of an ISR facility. Consequently, the GEIS concluded that the potential impacts of ground-water consumption during aquifer restoration could range from SMALL to MODERATE, depending on site-specific conditions.

Shallow Aquifers

Potential impacts to water quantity of the shallow aquifers during restoration would be reduced, compared to the construction and operation phases of the Proposed Action. The impact to the aquifers' water levels from consumptive use of water from the Oshoto Reservoir and the Little Missouri River would also be moderated, because of the lower-volume withdrawals from the surface-water bodies.

In addition, potential impacts to water quality would again be reduced when compared to the Proposed Action's operation because no lixiviant would be used in the injection stream and the concentration of chemicals in the recovered ground water would be significantly less than during ISR operations. The Applicant's implementation of BMPs during uranium-recovery operation would also reduce the likelihood and magnitude of spills and leaks, and thorough cleanup would be facilitated. The ground-water mitigation measures during aquifer restoration would be the same as those described for the operation of the Proposed Action. Thus, the potential impacts of aquifer restoration to ground-water quantity and quality of the shallow aquifers would be SMALL.

Ore-Zone and Surrounding Aquifers

The magnitude of potential impacts to water quantity of the OZ aquifer and the surrounding aquifers during the aquifer-restoration phase of the Proposed Action would be greater than from its operation because of the greater consumptive use of ground water (Strata, 2011a). Ground-water modeling estimates of the drawdown in the shallow-monitoring (SM) aquifer during both Ross Project operation and aquifer restoration were less than 5 m [15 ft]. The exempted OZ aquifer was predicted to experience significant drawdowns in three wells on the Ross Project area, with minor drawdowns in wells within 3.2 km [2 mi] of the Project. The conservative regional impact analysis conducted by the ground-water modeling predicts a reduction in the available head in wells used for stock, domestic, and industrial use. Although these effects would be localized and short-lived, the Applicant would commit to provide an alternative source of water of equal or better quantity and quality, subject to Wyoming water-statute requirements, in the event that aquifer-restoration operations prevent the full use of a well under a valid water right (Strata, 2011a; Strata, 2012a). Consequently, the potential impacts of the Proposed Action's aquifer-restoration phase to ground-water quantity of the confined aquifers would be SMALL to MODERATE.

The potential for excursions during aquifer restoration that would affect water quality in the aquifers vertically adjacent to the exempted OZ aquifer would be similar to those described earlier for the Proposed Action's operation. However, the magnitude of impacts would be less because the injection and recovery flow rates would be lower during aquifer restoration than during active uranium recovery and the ore-zone water quality would improve throughout active aquifer-restoration activities. The concentrations of radiological parameters and other chemical constituents in the permeate that would be injected as "clean" water to restore the exempted OZ aquifer would be lower than the pre-licensing baseline ore-zone water quality reported by the Applicant, except for radium-226 (Strata, 2011a). Dissolved radium-226 measured in the OZ aquifer has ranged from 0.03 Bq/L [0.71 pCi/L] to 0.44 Bq/L [12.01 pCi/L], and the typical radium-226 concentration is 1.1 Bq/L [30 pCi/L] (Strata, 2011a). The potential impacts of aquifer restoration to ground-water quality of the confined aquifers would be SMALL.

Deep Aquifers

The Applicant estimates that less than 860 L/d [227 gal/d] of brine and other byproduct wastes would be disposed in the Class I injection wells during aquifer restoration at the Proposed Action. Although the volume of waste injected would be greater during the aquifer-restoration phase than during the Ross Project's operation phase, the potential impacts would be similar because the injection pressures would not increase beyond the limit established by WDEQ's UIC Permit. These pressure limits would ensure that the capacity of the Class I receiving aquifer is not exceeded. The potential impacts from aquifer restoration to ground-water quality of the deep aquifers would, therefore, be SMALL.

4.5.1.4 Ross Project Decommissioning

The decommissioning activities of the Proposed Action that might impact surface water and/or ground water include the Applicant dismantling the CPP, auxiliary structures, and the surface impoundments; removing buried pipelines; excavating and removing any contaminated soil; plugging and abandoning wells using accepted practices; breaching the CBW; and restoring and revegetating all disturbed areas. Figure 4.1 indicates the components of the Proposed Action that would be in place by the end of its decommissioning.

Surface Water

As described in GEIS Sections 4.2.4 and 4.4.4, during the decommissioning phase, temporary impacts to water quality would be anticipated due to sediment loading during the excavation and removal of pipelines, drainage crossings, and other infrastructure (NRC, 2009). As the GEIS noted, an Applicant's compliance with permit conditions, its use of BMPs, and its observance of required mitigation measures would reduce decommissioning impacts to SMALL to MODERATE, depending upon site-specific conditions.

For the Proposed Action, the Applicant intends to use surface water from either the Oshoto Reservoir or the Little Missouri River for dust control and any demolition activities during the Project's decommissioning. As shown in Table 4.3, the Applicant estimates that approximately 42 L/min [11 gal/min] of surface water would be used during facility and wellfield decommissioning. This withdrawal rate is between the quantities of anticipated water use during the Proposed Action's construction and operation phases.

The primary impacts to surface water during the decommissioning of the Ross Project would be from activities associated with the removal of constructed Project components, reclamation and restoration of the land impacted during the Proposed Action, and the cleanup of any contaminated soils. These impacts would be similar to those that result from the construction of the Proposed Action. Removal of buried pipelines and the roads near stream channels during the decommissioning phase would result in temporary disturbances that could impact surface-water quality. Potential surface-water contamination could occur from spilled or leaked fuel or lubricants from construction equipment and passenger vehicles that would be operated during decommissioning activities, although the equipment would generally be located away from surface-water bodies. These potential impacts to surface-water quality would be mitigated using the same measures as implemented during the Proposed Action's construction (e.g., BMPs and spill-response protocols). The potential impacts to surface-water quantity and quality from the Ross Project's decommissioning would be SMALL.

The potential impacts to wetlands from the Proposed Action's decommissioning would be SMALL, as they would be the same as discussed under the Proposed Action's construction.

Ground Water

As described in GEIS Sections 4.2.4 and 4.4.4, the impacts to ground water during the decommissioning of an ISR facility are primarily associated with consumptive use of ground water, potential spills of fuels and lubricants, and well abandonment (NRC, 2009). Ground-water consumptive use during decommissioning activities would be less than during operation and aquifer-restoration activities. BMPs would reduce the likelihood of spills and leaks. After

ISR operations are completed and a facility is decommissioned, improperly abandoned wells could impact aquifers above the OZ aquifer by providing hydrological connections between aquifers (NRC, 2009). To ensure that this consequence does not happen at the Ross Project, all injection, recovery, and monitoring wells would be plugged and abandoned in accordance with UIC Permit requirements. The GEIS determined that implementation of BMPs and compliance with permit requirements would ensure that the potential impacts to ground water would be SMALL during decommissioning; the Proposed Action's decommissioning would include observance of these procedures and requirements.

Shallow Aquifers

During decommissioning, finger drains (see SEIS Section 2.1.1.4) would be created along the up-gradient and down-gradient sides of the CBW and backfilled with permeable material (gravel). These gravel-filled breaches in the CBW would create a highly permeable flow path through the CBW that would allow the natural flow of the shallow aquifer ground water beneath the CPP and in the immediate vicinity outside the CBW to be restored. Water levels would be monitored by the Applicant to verify that the CBW reclamation and ground-water restoration is complete. After uranium-recovery operation is complete, unidentified, improperly abandoned wells (i.e., from previous subsurface explorations not associated with the Applicant or its operations) could continue to impact aquifers above the ore-zone and adjacent aquifers by providing hydrologic connections between aquifers. The Applicant's implementation of BMPs and SOPs for the plugging and abandonment of its own wells during decommissioning of the Proposed Action would reduce the likelihood of shallow-aquifer contamination. In addition, other BMPs employed by the Applicant would reduce the likelihood and magnitude of spills and leaks during equipment and vehicular operation and would facilitate any soil or other cleanup required. Thus, the impacts to shallow aquifers during the Proposed Action's decommissioning would be SMALL.

Ore-Zone and Surrounding Aquifers

As part of the decommissioning of the Proposed Action and the concomitant land reclamation and restoration activities, all monitoring, injection, and production wells would be plugged and abandoned in accordance with the UIC Permit requirements. The wells would be filled with cement and/or bentonite and then cut off below plow depth to ensure ground water does not flow through the abandoned wells (Stout and Stover, 1997). Proper implementation of these procedures would isolate the wells from ground-water flow. Thus, the impacts to the ore-zone and vertically adjacent aquifers would be SMALL.

Deep Aquifers

The Applicant estimates that less than 38 L/day [10 gal/day] of brine and other liquid byproduct wastes would be disposed in the Class I injection wells during the decommissioning of the Proposed Action. The potential impacts to ground-water quantity and quality during decommissioning would be SMALL and less than the other phases of the Ross Project.

4.5.2 Alternative 2: No Action

Under the No-Action Alternative, the Ross Project would not be licensed and the land would continue to be available for other uses. Mud pits that could continue to be constructed at each well site to manage drilling fluids and muds would have little potential of impacting surface waters and no potential of impacting ground water. The roads across the Ross Project area would be graded, contoured, and revegetated, also leaving little potential for them to impact surface water by increasing sediments.

Similarly, although no license would be issued and no Ross Project would be constructed or operated in the No-Action Alternative, preconstruction activities would cause potential impacts. The respective impacts to ground water depend upon the density of plugged and abandoned wells and drillholes. As of August 2011, the Applicant had drilled and plugged approximately 612 holes it installed during site and geotechnical characterization; an additional 51 were drilled and are now used as site-characterization ground-water monitoring wells. The Applicant has also located and properly abandoned 55 Nubeth drillholes. Thus, the drillhole density is approximately 1 hole per 1 ha [2.5 ac]. Under the No-Action Alternative, the 51 monitoring wells, and any others that could be located, would need to be properly abandoned, where each well and drillhole would be filled with a concrete plug up to 6 inches in diameter through the entire depth of the hole. The low density of these properly plugged and abandoned wells and drillholes would not affect the ground-water flow or quality.

Thus, the potential impacts from the No-Action Alternative to surface and ground waters, relative to the existing Ross Site area and including the preconstruction activities that have already occurred, would be SMALL

4.5.3 Alternative 3: North Ross Project

Under Alternative 3, the North Ross Project would generally be the same as the Proposed Action, except that the facility (i.e., the CPP, associated buildings, and auxiliary structures as well as the surface impoundments) would be located to the north of where it would be located in the Proposed Action, as described in SEIS Section 2.1.3. The hydrology of the north site differs from that under the location of the CPP in the Proposed Action. The depth to the unconfined, shallow ground-water aquifer is greater, which would eliminate the need for a CBW. However, the north site contains two ephemeral streams rather than the one in the Proposed Action. These ephemeral drainages extend over 760 m [2,500 ft], before entering the Little Missouri River, compared to the Proposed Action where the facility is within 300 m [1,000 ft] of the Oshoto Reservoir and the Little Missouri River. Because of the drainage, the design of the facility could require that the CPP and the surface impoundments be constructed across a drainage that leads directly to the Little Missouri River. The ground's surface slopes to the southeast at a grade of 5 – 15 percent compared with a slope of less than 1 percent for the south location in the Proposed Action. Thus, the construction of the surface impoundments on the steeper slope would require a large increase in the area of disturbed land and would require that significant design and engineering considerations be addressed in order to mitigate potential impacts to surface water.

Nonetheless, most of the potential impacts of and mitigation measures for this Alternative would be the same as for the Proposed Action. Only the differences in impacts between the Proposed Action and the North Ross Project are described below.

4.5.3.1 North Ross Project Construction

Impacts to surface and ground waters during construction are expected to be generally the same as the Proposed Action, although the steeper slopes at the north site would require more engineering and construction activity. As a result, there would be a slight increase in the potential for impacts to surface and ground waters in the shallow aquifer. However, the impacts to shallow ground water in the Proposed Action, which result from the construction of the CBW and, in particular, the alteration of the surficial ground-water flow regime, would not be a consequence of this Alternative. At the north site, shallow ground-water levels are estimated to be at a depth of greater than 15 m [50 ft], within the sandstones of the LA interval of the Lance Formation (as discussed in SEIS Section 3.4); however, during high-precipitation events or after significant snowmelt, perched ground water could be present above the regional water table. If the CBW is not needed and not constructed by the Applicant, then the need for dewatering the shallow aquifer would be eliminated and thereby would reduce the consumption of ground water by a small amount.

Construction of the storm-water control system and implementation of BMPs during construction of the Alternative 3 facility would be more involved, in order to protect the two ephemeral drainages from impacts of erosion and increased sediment loads. If the Alternative 3 design required the CPP and the surface impoundments to be separated by a drainage (as shown in Figure 2.11 in SEIS Section 2.1.3), the construction of the pipeline network would also require additional construction and engineering activity. However, the BMPs during construction would minimize potential impacts to surface and ground waters from construction of Alternative 3; thus, the impact would still be SMALL.

4.5.3.2 North Ross Project Operation

Alternative 3 would result in many of the same potential impacts to surface water during its operation as the Proposed Action's. The proximity of the facility to two ephemeral drainages would increase the risk of surface-water impacts from spills and leaks, where the released material could make its way into surface water. The potential for impact to surface water would be mitigated by the distance of approximately 0.8 km [0.5 mi] to the Little Missouri River. The greater distances from the CPP to the Little Missouri River in Alternative 3, when compared to those of the Proposed Action, would also strengthen the natural mitigation of impacts from discharge of excess permeate. Operation of the wellfields during the North Ross Project would be the same as during the Proposed Action and, therefore, the potential impacts and mitigation measures associated with the wellfields would be the same. Thus, the potential impacts to surface water of Alternative 3's operation would be SMALL.

The greater thickness of the vadose (i.e., unsaturated) zone under the north site would also provide additional natural protection to the shallow ground water in the event of a release of process chemicals, recovery solutions, or liquid wastes within the CPP and surface-impoundment areas. If contaminants reached the ground water, remediation by pump-and-treat methods would be required. With the Proposed Action, ground-water levels within the CBW would be maintained lower than surrounding and underlying ground-water levels, and would thus prevent any migration of contaminants away from the CPP and surface impoundments. Because there would be no difference between the location and operation of the wellfields under Alternative 3 as compared with the Proposed Action, the potential MODERATE impacts from lixiviant excursions discussed in SEIS Section 4.5.1.2 could also occur under Alternative 3.

Therefore, the potential impacts to ground water of the operation of Alternative 3 would be SMALL to MODERATE due to the potential for lixiviant excursions.

4.5.3.3 North Ross Project Aquifer Restoration

Because the wellfields would be in the same locations in Alternative 3, this Alternative does not include any modifications to the wellfields from what was described for the Proposed Action (because they follow the subsurface uranium mineralization), the wellfields would result in the same potential impacts to ground water during Alternative 3's aquifer restoration phase as in the Proposed Action. These potential impacts would be SMALL to MODERATE, due to potential drawdowns during aquifer restoration.

4.5.3.4 North Ross Project Decommissioning

Alternative 3 would result in generally the same potential impacts to surface and ground waters during its decommissioning as would the Proposed Action, with the following exceptions: The surface-impoundment area requiring recontouring and revegetation would be larger and more extensive; thus, the potential for surface-water impacts associated with these activities would be marginally greater. Unlike with the Proposed Action, it would not be necessary to cut gravel-filled channels through a CBW, thereby eliminating the potential for the associated surface-water impacts. The potential impacts during Alternative 3's decommissioning to the surface drainages through the north site would be the same as described above for Alternative 3's operation. The potential impacts to surface and ground waters from decommissioning of Alternative 3 would be SMALL.

4.6 Ecology

The Proposed Action could impact ecological resources, including both flora and fauna during all phases of the Project's lifecycle. These impacts could include removal of vegetation from the Ross Project area; reduction in wildlife habitat and forage productivity, and an increased risk of soil erosion and weed invasion; the modification of existing vegetative communities; the loss of sensitive plants and habitats; and the potential spread of invasive species and noxious weed populations. Impacts to wildlife could include loss, alteration, or incremental fragmentation of habitat; displacement of and stresses on wildlife; and direct and/or indirect mortalities. Aquatic species could be affected by disturbance of stream channels, increases in suspended sediments, pollution from fuel spills, and habitat reduction. The potential environmental impacts to and related mitigation measures for ecological resources during the construction, operation, aquifer restoration, and decommissioning of the Proposed Action and the two Alternatives are discussed in the following sections.

4.6.1 Alternative 1: Proposed Action

Alternative 1, the Proposed Action, consists of four phases: construction, operation, aquifer restoration, and decommissioning of an ISR uranium-recovery facility and wellfields.

4.6.1.1 Ross Project Construction

As discussed in GEIS Section 4.4.5, the potential impacts to terrestrial vegetation during the construction of ISR facilities could include removal of vegetation from ISR facility sites (and the associated reduction in wildlife habitat and forage productivity and the increased risk of soil erosion and weed invasion), the modification of existing vegetative communities, the loss of sensitive plants and habitats as a result of site clearing and grading, and the potential spread of invasive species and noxious weed populations (NRC, 2009).

The construction phase of the Proposed Action could potentially impact the local ecology during the Applicant's clearing vegetation and leveling the site; constructing the CPP, auxiliary structures, and surface impoundments; developing the wellfields, including drilling wells, laying pipelines, constructing header houses, and other wellfield components; constructing access roads; clearing storage, parking, and laydown areas; and installing associated infrastructures such as utility and lighting systems. The ecological impacts of these construction activities are evaluated for protected species, vegetation, and wildlife.

<u>Terrestrial Species</u>

Vegetation

The construction of the Ross Project facility (i.e., CPP and surface impoundments) as well as the installation of wellfields would take place within the nine vegetation communities present at the Project area (upland grassland, sagebrush shrubland, pastureland, hayland, reservoir/stock pond, wetland, disturbed land, cropland, and wooded draw) (see SEIS Section 3.2). Direct impacts of such construction would include the short-term loss of vegetation (structure modification, species composition, and areal extent of cover types). An estimated 113 ha [280 ac] of land disturbance would occur; one-half of this disturbance would occur within the upland grassland vegetation community, primarily because of wellfield-module and access-road construction.

Only 7 percent of the Ross Project area is currently hayland; however, 20 – 30 percent of the impacts would be to this vegetation community because of construction of the CPP and surface impoundments. Indirect impacts include the short-term and long-term increased potential for non-native species invasion, establishment, and expansion; exposure of soils to accelerated erosion; shifts in species composition or changes in vegetation density; reduction of wildlife habitat; and reduction in livestock foraging opportunities.

Sagebrush shrubland, the second largest vegetation type on the Ross Project area, can be difficult and time-consuming to re-establish. Consequently, preconstruction vegetation communities and sub-communities (i.e., shrub-steppe) may be different than post-construction communities (i.e., grass-dominated) for several years, or possibly decades, which could alter the composition and abundance of both plant and wildlife species in the area. Site reclamation and/or regeneration of native shrub species could be further hindered by year-long grazing pressure. Large ungulates (i.e., wild and domestic animals with hooves) are attracted to the more succulent, younger plants, and they often concentrate in newly seeded locations during the critical early-growth stage. Impacts to the sagebrush-shrubland vegetation type would be minimized by the Applicant reducing surface disturbance where possible, distributing a temporary seed mixture to prevent invasion of non-native species in disturbed areas, restoring sagebrush and other shrubs on reclaimed lands, and conducting all re-vegetation activities in accordance with an approved WDEQ/LQD reclamation plan (Strata, 2011b).

Construction activities, including the increased soil disturbance and increased traffic during construction, could stimulate the introduction and spread of undesirable and invasive, non-native species at the Ross Project area. Several species of designated and prohibited noxious weeds listed in the Wyoming *Weed and Pest Control Act* were identified on the Ross Project area. These species included field bindweed, perennial sow thistle, quack grass, Canada thistle, hounds tongue, leafy spurge, common burdock, Scotch thistle, Russian olive, and skeletonleaf bursage (Strata, 2011a). These species could be locally abundant in small areas, especially around the Oshoto Reservoir and along the Little Missouri River and Deadman Creek, but they were not common over the entire Ross Project area.

The impact from vegetation removal and surface disturbance would affect approximately 113 ha [280 ac] of land, or about 16 percent of the Proposed Action's area. Construction would be phased over time, further reducing the amount of surface area disturbed at any one time. Noxious weeds would be controlled with appropriate spraying techniques. Therefore, the impacts to terrestrial vegetation would be SMALL.

In addition, the potential impacts to vegetation during the Proposed Action's construction would be mitigated by the Applicant's ensuring that disturbed areas would be both temporarily and permanently revegetated in accordance with WDEQ/LQD regulations and its WDEQ Permit to Mine. The Applicant would seed disturbed areas to establish a vegetative cover to minimize wind and water erosion and the invasion of undesirable plant species. The impacts would be further mitigated by a phased approach to construction, and therefore surface disturbance would be phased. A temporary seed mix could be used in wellfields and other areas where the vegetation would be disturbed again prior to final decommissioning and final revegetation. The temporary seed mix typically would consist of one or more of the native wheatgrasses (e.g., western wheatgrass and thick-spike wheatgrass). Permanent seeding is accomplished with a seed mix approved by the WDEQ/LQD and with County conservation district requirements. Two permanent reclamation seed mixtures (upland and pastureland/hayland) would be used to reseed disturbed areas. Wellfield areas would be fenced as necessary to prevent livestock access, which would also enhance the establishment of temporary vegetation (Strata, 2011a). The Applicant would conduct weed control as needed to limit the spread of undesirable and invasive, non-native species on disturbed areas (Strata, 2011a).

Wildlife

As discussed in GEIS Section 4.4.5, in general, wildlife species would disperse from an area undergoing construction, although smaller, less-mobile species could perish during clearing and grading. Habitat fragmentation, temporary displacement, and direct or indirect mortalities are possible, and thus the GEIS concluded that construction impacts on wildlife could range from SMALL to MODERATE (NRC, 2009). These types of impacts could be mitigated during the Proposed Action if standard management practices suggested by the WGFD were to be followed. Moreover, impacts on raptor species from power distribution lines could be mitigated by the Applicant's following the Avian Power-Line Interaction Committee (APLIC) guidance and avoiding disturbance of areas near active nests and prior to the fledging of young (APLIC, 2006).

Mammals

The Ross Project area provides year-long range to pronghorn antelope, and winter/year-long range for mule deer, but it is considered outside of the normal range for white-tailed deer and elk (see SEIS Section 3.6.1). White-tailed deer, however, were observed during the Applicant's wildlife surveys as were pronghorn antelope. No crucial big-game habitats or migration corridors are recognized by the WGFD at the Ross Project area or the surrounding 1.6-km [1-mi] perimeter. (A crucial range or habitat is defined as any particular seasonal range or habitat component that has been documented as the determining factor in a population's ability to maintain and reproduce itself at a certain level.) Therefore, there would be no direct impact on big-game's crucial habitat, critical or key winter or summer ranges, or migration corridors. Direct impacts on white-tailed deer and elk could include direct loss and modification of habitat, increased mortality from increased traffic collisions on local and regional roads, increased competition for and reduction of available forage, increased conflicts with vehicles because of changes in wildlife movement patterns, and increased disturbance due to the presence of humans. White-tailed deer and elk could be indirectly affected during construction by displacing portions of these populations from the Ross Project area into offsite suitable regional habitat. Because the Project area provides only nonessential habitat for white-tailed deer and elk, impacts to these species would be SMALL.

The direct impacts on pronghorn antelope and mule deer could be the same as those described previously for white-tailed deer and elk. The construction phase of the Proposed Action has been estimated to last 12 months. Adequate habitat for pronghorn antelope and mule deer exists in the surrounding area, and these species could return to the areas affected by construction when the activities are complete. The staged restoration of disturbed areas that the Applicant proposes would provide grass and forage within a few years of habitat disturbance. The movement of big game through the Ross Project would not be significantly impacted by the Proposed Action. The Applicant has committed to implementing mitigation measures, such as reduced speed limits to reduce the risk of vehicular collision, fences designed to permit big game passage, and use of existing roads where possible to avoid altering wildlife movement patterns. Because pronghorn antelope and mule deer are highly mobile species, the potential impact to these species would be SMALL.

A variety of small- and medium-sized mammals are also potentially found on the Ross Project area (see SEIS Section 3.6.1) (Strata, 2011a). These include a variety of predators and furbearers, such as coyote, red fox, raccoon, bobcat, badger, beaver, and muskrat. Prey species observed during the Applicant's field surveys included rodents (e.g., mice, rats, voles, gophers, ground squirrels, and chipmunks), jackrabbits, and cottontails. These species are cyclically common and widespread throughout the region and are important food sources for raptors and other predators.

Medium-sized mammals (e.g., coyotes, foxes) could be temporarily displaced to other habitats during construction activities. Direct losses of limited-mobility, small-mammal species (e.g., voles, ground squirrels, mice) could be higher than for other wildlife because of the likelihood they would retreat into burrows if disturbed, and thus potentially be killed by topsoil scraping or staging activities. However, given the limited, noncontiguous area that would be disturbed (approximately 113 ha [280 ac]), no major changes or reductions in small- or medium-sized mammal populations would be expected. The species that occur in the area have shown an ability to adapt to human disturbance in varying degrees, and each also has a high reproductive potential and tend to re-occupy and adapt to altered or reclaimed areas quickly. Because only a few individuals would be affected, and most mammal species would likely travel to suitable habitat near the Ross Project area during its construction, the Proposed Action would have a SMALL impact on these mammals.

Birds

Potential impacts to upland game birds at the Ross Project area include nest destruction or nest desertions, reproductive failure as a result of proposed construction activities and increased presence of humans, or increased mortalities associated with traffic. Four upland game-bird species occur within or near the Ross Project area (i.e., wild turkey, sage-grouse, sharp-tailed grouse, and mourning doves) (Strata, 2011a). Suitable habitat (for nesting, brood-rearing, and foraging) for these four species exists in the Ross Project area; however, as previously discussed, there are no sage-grouse core areas or connectivity corridors within the Project area. Because of the type of disturbance (the relatively small areas of disturbance and the sequential nature of the disturbance), impacts to upland game birds as a result of the Proposed Action would be SMALL.

Potential impacts to raptors within the Ross Project area also include nest desertions or reproductive failure as a result of construction activities and increased presence of humans; temporary reductions in prey populations; and mortality associated with traffic. Six raptor species on the USFWS SMC list (i.e., bald eagle, Swainson's hawk, ferruginous hawk, golden eagle, prairie falcon, and short-eared owl) have been observed within or near the Project area (Strata, 2011a). Swainson's and ferruginous hawks are the only species known to nest in the area. One intact raptor nest (a Swainson's hawk nest, No. SH1) was located at the Ross Project area during the Applicant's field surveys. Seven intact nests and one nest no longer intact were located with 1.6 km [1 mi] of the Project area. The nest within the Ross Project area would not be directly disturbed during the Proposed Action's construction, so nesting raptors would not be directly impacted. Foraging raptors are expected to be able to avoid any areas of disturbance. Because of the type of disturbance (again, the relatively small areas of disturbance and the sequential nature of the disturbance) and the fact that no raptor nests would be directly affected, impacts to raptors during the Proposed Action would be SMALL.

Potential impacts to nongame or migratory birds within the Ross Project area include nest destruction or desertions, or reproductive failure as a result of construction activities during the Proposed Action. Increased mortality associated with the increased traffic during the construction phase could also occur. The field surveys completed by the Applicant identified 27 nongame or migratory avian species within the Ross Project area (Strata, 2011a). Because of the type and sequence of land disturbance, the Proposed Action's construction impacts to nongame or migratory birds would be SMALL.

Thus, all impacts to terrestrial wildlife would be SMALL.

Reptiles, Amphibians, and Aquatic Species

Potential impacts to reptiles, amphibians, and fish during construction of the Proposed Action would primarily be the result of the mortality of individuals and destruction of habitat. Sediment loads in surface waters and wetlands from surface-disturbing activities could also potentially impact aquatic habitat, although potential impacts would be greatly reduced through sediment-control BMPs. Up to 0.8 ha [2 ac] of wetland habitat could be disturbed as a result of construction; however, all wetland disturbance would be mitigated in accordance with USACE requirements found in the CWA permit.

Because of the type of disturbance, which would be relatively small, and the sequential nature of the disturbance as well as the fact that aquatic habitats would be avoided if at all possible during construction, impacts to reptiles, amphibians, and fish during the Proposed Action would be SMALL.

Protected Species

As discussed in SEIS Section 3.6.1.4, a protected species of bird, the Greater sage-grouse could occur on the Ross Project area. The nearest active sage-grouse lek (i.e., Cap'n Bob), a mating-strutting area for male sage-grouse, is located approximately 3.5 km [2.2 mi] southeast of the Ross Project area. There is also an inactive-status lek (for 2010) within 1.6 km [1 mi] of the Project's boundary. Wyoming policy states that surface-disturbing and/or disruptive activities are prohibited or restricted from March 15 through June 30. This restriction is typically only applied to suitable sage-grouse nesting and early brood-rearing habitat, within mapped habitat important for connectivity, or within 3 km [2 mi] of any occupied or "undetermined lek." The leks observed by the Applicant are outside of the Proposed Action area and are not located in proximity to any proposed construction or operation activities at the Proposed Action. However, if a Greater-sage-grouse lek were to be identified within the Ross Project area at any time during the Ross Project, including construction, the Applicant would follow WGFD policy regarding construction-activity restrictions. The Applicant would continue to consult with WGFD and WDEQ/LQD to determine if a sage-grouse monitoring, protection, and habitat enhancement plan would be necessary for the Ross Project, and a plan would be developed and implemented, if warranted.

During the Applicant's field surveys, the northern leopard frog was the only U.S. Bureau of Land Management (BLM)-listed reptile, amphibian, or fish sensitive species actually observed in the Ross Project area; three amphibian and five reptile Wyoming SOC were observed (Strata, 2011a). Impacts to protected avian, amphibian, and reptile species would be no different than those for other similar species because the Applicant would observe appropriate activity restrictions, attempt to avoid aquatic habitats during road construction, and implement the mitigation measures below.

The potential impacts to ecological resources associated with construction activities during the Proposed Action would be limited due to the relatively small area of surface disturbance. Nevertheless, mitigation measures to prevent or further reduce impacts to wildlife would include one or more of the following, as addressed by the various regulatory and permit-issuing agencies:

- Design of fencing to permit big-game passage as required by the WGFD.
- Use of existing roads when possible and location of newly constructed roads to access more than one well location according to BLM requirements.

- Implementation of speed limits to minimize collisions with wildlife, especially during the breeding season, according to a MOU between the Applicant and Crook County transportation authorities (Strata, 2011d).
- Adherence to temporal and spatial restrictions within specified distances of active sage-grouse leks as determined through consultation with the WGFD and the WDEQ/LQD.
- If direct impacts to raptors or migratory-bird SMC result from construction, a monitoring and mitigation plan (MMP) for those species would be prepared and approved by the USFWS, and would include one or more of the following provisions:
  - Relocation of active and inactive raptor nests that would be impacted by well drilling and other construction activities in accordance with the approved raptor MMP
  - Institution of buffer zones to protect raptor nests where necessary and restriction of uranium-recovery-related disturbances from encroaching within buffers around active raptor nests (from egg-laying until fledging) to prevent nest abandonment or injury to eggs or young
  - Restoration of the ground cover necessary to attract and sustain a suitable raptor-prey base after drilling, construction, and future uranium-recovery activities, and
  - Requirement for the use of raptor-safe construction for overhead power lines according to current guidelines and recommendations by the APLIC and/or the USFWS.
- Restoration of sagebrush and other shrubs on reclaimed lands and grading of reclaimed areas to create swales and depressions for sagebrush obligates (sagebrush obligates are those species that need sagebrush to survive, e.g., sage grouse) and their young per WDEQ/LQD requirements.
- Restoration of preconstruction, native habitats for species that nest and forage in those vegetative communities according to WDEQ/LQD and WGFD requirements.
- Restoration of diverse landforms, replacement of topsoil, and the construction of brush piles, snags, and/or rock piles to enhance habitat for wildlife per WDEQ/LQD requirements.
- Restoration of habitat provided by jurisdictional wetlands as required by both the WDEQ/LQD and the USACE.

Thus, with the measures listed above, the environmental impacts to terrestrial, aquatic, and protected species during Ross Project construction would be SMALL.

4.6.1.2 Ross Project Operation

As discussed in GEIS Section 4.4.5, alteration of wildlife habitats could result from uranium-recovery activities (e.g., fencing, traffic, and noise), and conflicts between species habitat and uranium-recovery activities could occur (NRC, 2009). The GEIS further noted the occurrence of temporary contamination of soils from spills and leaks during ISR operation. However, rapid discovery and response to spills and leaks (i.e., spill containment and cleanup of potentially impacted soil), and the eventual survey for radiation during decommissioning, would limit the magnitude of overall impacts to terrestrial ecology during the Proposed Action’s operation. Leak-detection systems and spill-response plans would reduce the potential impacts to aquatic species from spills around wellheads and leaks from pipelines by preventing contamination of soils, surface waters, or wetlands. Additional mitigation measures such as perimeter fencing, surface-impoundment netting or other avian deterrents, and periodic wildlife surveys would also limit impacts during the Proposed Action's operation.

Terrestrial Species

Vegetation

During the operation phase of the Proposed Action, the wellfields and CPP would be frequently accessed by use of the existing roads. The installation and operation of the wellfields would involve the excavation of trenches for trunk lines and utilities; this surface disturbance would increase the susceptibility of the disturbed area to invasive and noxious weeds. However, surface disturbance would continue to be minimized during operation as new, additional wellfields are installed, and vehicular access would be restricted to specific roads. The potential for these impacts to occur during operations is less than that during construction, due to fewer hectares or acres of land being disturbed. There is a potential for impacts to vegetation from spills around wellheads and leaks from pipelines during the Ross Project's operation. Based upon the small amount of land that would be disturbed during operation, and the lower number of vehicles accessing the Ross Project, the impacts would be SMALL during the operation phase of the Proposed Action.

Wildlife

Wildlife use of areas adjacent to and near the Proposed Action would likely initially decline because of human presence during the Project's operation and steadily increase to near-normal levels once animals become habituated to the uranium-recovery activities. Because wildlife could be in fairly close proximity to the CPP, surface impoundments, wellfields, and roads, some impacts to wildlife would be expected from direct conflict with vehicular traffic and the presence of Strata's onsite personnel. In addition, wildlife could be exposed to contaminated soil resulting from spills and leaks. All of these impacts would be SMALL, however, because only a few individual animals would be affected, the potential for spills and leaks is low, and the continued existence of any particular species at the Ross Project area would not be affected. Potential impacts to terrestrial wildlife during the Ross Project's operation phase from process waste water and sediment in the facility's lined surface impoundments would be reduced by the fencing that would be installed around the entire facility (i.e., around the CPP and the surface impoundments) (see Figure 3.1 in SEIS Section 3.2). Therefore, during the operation of the Proposed Action, the potential impacts to wildlife would be SMALL.

Mammals

The potential impact to big game during the Proposed Action's operation phase would either be similar to or less than that described earlier for the construction phase, because limited earth-moving activities would occur. Therefore, there would be only SMALL impacts to big game species during the operation phase of the Proposed Action. The potential impacts to other mammals during operation of the Ross Project would also be similar to or less than that described earlier for the construction phase. Because only a few individual mammals would be affected, and most mammal species would likely travel to suitable habitat outside of the operating facility and wellfields, the Proposed Action would have SMALL impacts on these mammals during its operation.

Birds

The potential impacts to upland game birds, waterfowl, shorebirds, and raptors during the Proposed Action's operation would either be the same or less than that described earlier for the construction phase because earth-moving activities would be more limited during its operation phase.

For avian control at the surface impoundments, the Applicant is considering three options, including netting, "bird balls" (hollow or water-filled balls), or a radar-hazing system (Strata, 2012a). Following an extensive literature review and contact with knowledgeable individuals regarding avian deterrents for impoundments, a radar-hazing system has been identified by the Applicant as the most likely solution for its deterring avian species from the surface impoundments associated with uranium-recovery activities. This system uses radar to detect incoming waterfowl and then uses hazing techniques (primarily noise) to scare the birds away. The avian-deterrent system would require setup and routine maintenance, including calibration of the radar to site-specific conditions to avoid false activations. The potential for other wildlife to access the surface impoundments would be minimized by the installation of fencing around the CPP and surface impoundments. Additionally, BMPs would be the same as those used by the Applicant during construction; therefore, the potential impacts of the Proposed Action's operation would be SMALL for these birds.

Reptiles, Amphibians, and Aquatic Species

The potential impact to reptiles and amphibians from the Proposed Action's operation would be comparable to that described earlier for its construction. Because the potential habitat for reptiles and amphibians is limited within the Ross Project area, the potential impacts would be limited and SMALL. Because of the limited occurrence of surface water and, thus, of aquatic species at the Project area, the potential impact to aquatic species would be SMALL.

Protected Species

No impacts to Federally-listed threatened and endangered species would occur during the operation phase because these species have not been identified at the Ross Project area. Potential impacts to the protected species during the Project's operation would be the same or less than those discussed above for the construction of the Ross Project because there would be fewer humans present outdoors on the site itself and fewer vehicles being used. In general, outdoor activities would be limited. Thus, the impacts would be SMALL to all protected species. In addition, mitigation measures implemented during the Project's construction would continue to be employed to ensure that potential impacts to protected species remain SMALL.

As noted in SEIS Section 4.6.1.1, specific mitigation measures for all ecological resources would be required by several Federal and State agencies; these measures would be implemented during the Proposed Action's operation. These include the Applicant reseeding disturbed areas with WDEQ- and County-approved seed mixtures to prevent the establishment of competitive weeds and monitoring of invasive and noxious weeds. If these weeds become an issue, then the Applicant would employ other control alternatives, such as the application of herbicides, to minimize their impacts. In addition, impacts to vegetation and wildlife resulting from spills and leaks would be mitigated by the Applicant's use of BMPs. BMPs would include several leak-detection systems and spill-response plans, where released solutions would be contained and affected soils would be removed, thereby reducing the impacts of such releases.

All impacts of the Proposed Action's operation would be SMALL to the ecology of the area.

4.6.1.3 Ross Project Aquifer Restoration

In GEIS Section 4.4.5, the potential impacts to ecological resources during the aquifer-restoration phase of an ISR facility are described (NRC, 2009). These impacts were noted to include habitat disruption. As noted above, however, in the case of the Ross Project, the already in-place infrastructure from the construction and operation phases (i.e., roads) would continue to be used, and little additional ground disturbance would be expected.

Contamination of soils and surface waters could result from spills and leaks, which could impact the ecological resources of the Ross Project. The leak-detection systems and spill-response protocols described earlier, and the eventual radiation survey of all potentially impacted soils and sediments, would limit the magnitude of overall impacts to terrestrial and aquatic ecology during the aquifer restoration at the Proposed Action. In addition, continued implementation of mitigation measures, such as perimeter fencing and the avian-deterrent system would ensure that impacts to vegetation and terrestrial species would be minimized during aquifer restoration at the Ross Project. Also, because the existing infrastructure would be in place, the potential impacts to ecological resources from aquifer-restoration activities would be similar or less than that experienced during the Proposed Action's operation phase, wildlife would have already retreated or learned to tolerate the presence of humans or noise. Therefore, the potential impacts to vegetation and wildlife would be SMALL.

There would be no expected impacts to protected species during aquifer restoration beyond those which occurred during the construction and operation phases of the Proposed Action, because the existing infrastructure would be in place and no further excavation of habitat would be necessary. Additionally, to date, no threatened or endangered species have been observed at the Ross Project area. Therefore, the overall impact to threatened, endangered, or protected species during aquifer restoration would be SMALL.

4.6.1.4 Ross Project Decommissioning

As discussed in GEIS Section 4.4.1, temporary land disturbance during the decommissioning of ISR facilities would be a result of excavation and disturbance of soils; excavation and removal of buried pipelines; and the decontamination, dismantling, demolition, and removal of buildings and structures (NRC, 2009). However, any recontouring of land and its revegetation would assist in the restoration of habitats previously altered during an ISR facility's construction and operation. Wildlife would be temporarily displaced during the decommissioning phase, but species could return upon completion of this phase, when the restoration of vegetation and habitat has been accomplished. Although facility decommissioning and site restoration would result in temporary increases in sediment load in local streams, aquatic species would recover quickly as the additional sediment load decreased. For all of these reasons, the GEIS concluded the overall potential impact during the decommissioning of an ISR facility would be SMALL.

The Proposed Action's decommissioning would be phased over approximately the last five years of the Ross Project. The Applicant estimates a 12-month duration for the decommissioning of the CPP, surface impoundments, pipelines, roads, and other infrastructure (if the CPP does not continue to operate for satellite and/or other offsite uranium-loaded IX-resin processing). Stockpiled topsoil would be used to regrade the land to its pre-licensing baseline contours, as required, and be reseeded with native vegetation when the buildings and structures are removed as described earlier (see SEIS Section 2.1.1). No loss of vegetative communities beyond that disturbed during the construction phase would occur. Pipeline removal would impact vegetation that could have re-established itself, although this, too, would be temporary as the disturbed areas are reseeded. Thus, the impacts of the Proposed Action's decommissioning would not be expected to be greater than those experienced during its construction, and mitigation measures would continue to be employed. Consequently, the decommissioning impacts to vegetation would be SMALL.

The decommissioning of the Proposed Action would create increased noise and traffic as buildings and structures are decontaminated, dismantled, demolished, and transported offsite to an appropriate waste-disposal facility. During this time, wildlife could either come in conflict with heavy equipment or be disrupted by the higher-than-normal noise. As a result of these impacts, wildlife would move elsewhere either on the Ross Project area or onto other lands. Temporarily displaced wildlife could return to the Ross Project area after the Proposed Action's decommissioning and site restoration are complete. Further, as required by NRC regulations, the Applicant would be required to submit a decommissioning plan for Commission review and approval, which would address ecological impacts such as these. Thus, decommissioning impacts of the Ross Project would not be more than those experienced during the Proposed Action's construction. Thus, the impacts to terrestrial wildlife, aquatic species, and protected species during decommissioning would be SMALL.

4.6.2 Alternative 2: No Action

Under the No-Action Alternative, the Ross Project would not be licensed and the land would continue to be available for other uses. However, activities such as the plugging and proper abandonment of existing drillholes would occur as well as continued environmental monitoring, data collection, and field surveying. These activities, however, would be temporary in nature and the surface area affected would be very limited.
The Ross Project area would continue to support vegetation communities and wildlife habitat typical of the region (as described in SEIS Section 3.). Land use would continue as pastureland, and existing grazing leases would continue. Grazing of existing vegetation, particularly in the grassland communities, would continue. Existing wildlife on the Ross Project area would be affected only if continued cattle grazing destroys wildlife habitat or if species are displaced by cattle populations because of lack of forage and cover. However, in this Alternative, only a few individual species would be affected, and they would relocate to suitable nearby habitats. Therefore, vegetation and wildlife impacts would be SMALL.

4.6.3 Alternative 3: North Ross Project

Under Alternative 3, the North Ross Project would generally be the same as the Proposed Action, except that the facility (i.e., the CPP, associated buildings, and auxiliary structures as well as the surface impoundments) would be located to the north of where it would be located in the Proposed Action, as described in SEIS Section 2.1.3. The Applicant's construction of the

CPP at this location would produce a slight increase in the travel distance for vehicles accessing the Ross Project's facility and wellfields. This could slightly raise the potential for vehicular collisions with wildlife. However, the potential impacts during construction of Alternative 3 would be similar to those described for the Proposed Action. In addition, the surface impoundments would be located farther away from the Oshoto Reservoir, which would reduce the likelihood of waterfowl and other wildlife entering the surface impoundments. This would reduce the impacts to wildlife during the operation and aquifer-restoration phases of Alternative 3. All other impacts would be the same as for the Proposed Action, and the same mitigation measures would be implemented. The impacts of the North Ross Project would be of the same magnitude as during the Proposed Action, and they would be SMALL.

4.7 Air Quality

The Proposed Action could impact air quality during all phases of the Project's lifecycle. As discussed in GEIS Section 3.4.6 and in SEIS Section 3.7.1, Wyoming is generally a very windy state and ranks first in the U.S. with an annual average wind speed of 6 m/s [13 mi/hr]. During winter, wind speeds in Wyoming can reach 13 – 18 m/s [30 – 40 mi/hr] with gusts to 22 – 27 m/s [50 – 60 mi/hr] (NRC, 2009). During the 12 months of pre-licensing baseline monitoring at the Ross Project area, the onsite meteorology station recorded average annual wind speeds of 19 km/hr [12 mi/hr], with a maximum wind speed of 74 km/hr [46 mi/hr]. Southerly winds were predominantly recorded at the Ross Project area. These data suggest that combustion-engine and fugitive-dust emissions from the Ross Project would be moved by the highest wind speeds to the south-southeast, away from the Project area.

In addition to the winds, the Ross Project area and the surrounding region receive relatively little rainfall, with average annual precipitation ranging from 25 – 38 cm [10 – 15 in]. The region receives an average annual snowfall of 127 – 152 cm [50 – 60 in]; approximately one-half of the precipitation is associated with spring snows and thunderstorms. At the Ross Project meteorological station, the total precipitation measured in 2010 was 24.8 cm [9.8 in] (Strata, 2011a).

Because the Ross Project area is very dry and very windy, fugitive dust is readily generated and is a significant air pollutant (i.e., unwanted chemical vapor, gaseous, or particulate emissions found in the air, especially in disturbed land areas and areas where native vegetation has been removed). Conversely, these high winds could also more rapidly disperse air pollutants, lowering their concentrations. But the arid conditions in the Ross Project area are not as conducive to removal of suspended dust as areas receiving more rainfall. Therefore, in general, other mechanisms besides precipitation would need to be implemented within the Ross Project area to minimize fugitive dusts and other air emissions.

Air pollutants can also be affected by the regional landscape of an area. The Ross Project's topographical setting—an area consisting of rolling hills and intermittent drainages—provides some topographic breaks (see SEIS Section 2.1.1) (Strata, 2011a). In addition, the nearest mountain range is the Black Hills, whose westernmost edge is approximately 32 km [20 mi] from the eastern boundary of the Ross Project area. It has been suggested that this range may shield easterly winds and channel predominant winds into a north-south pattern (Strata, 2011a).

Finally, atmospheric-stability classification and mixing height are environmental variables that also influence the ability of the atmosphere to disperse air pollutants. The "stability class" is a measure of atmospheric turbulence and "mixing height" characterizes the vertical extent of contaminant mixing in the atmosphere. Stability-class information was collected at the Ross Project meteorological station (Strata, 2011a) and indicated that the class distributions were predominantly neutral (approximately 62 percent of the time).

This background information indicates that potential impacts to air quality could occur during all phases of the Ross Project, and the impacts could be related to both the particulate emissions (e.g., fugitive dust) as well as gaseous emissions (or effluents) (e.g., combustion-engine emissions) that would be released during the Ross Project. Consistent with the GEIS, the air quality impacts analyzed in Section 4.7 only cover nonradiological emissions. Radiological emissions and dose information are addressed in the public and occupational health and safety impacts analyses in Section 4.13.

4.7.1 Alternative 1: Proposed Action

Alternative 1, the Proposed Action, consists of four phases: construction, operation, aquifer restoration, and decommissioning of a uranium-recovery facility and wellfields. The GEIS in Section 4.2.6 as cited in GEIS Section 4.4.6 determined that uranium-recovery facilities are not, in general, major air-emission sources (NRC, 2009). Given the low levels of particulate and gaseous emissions predicted in GEIS Section 4.2.6, the GEIS determined that the overall potential air-quality impacts of an ISR facility are SMALL, if the following three conditions could be applied to a specific facility: 1) particulate and gaseous emissions are within regulatory limits and requirements; 2) air quality in the [region] is in compliance with the National Ambient Air Quality Standards (NAAQS); and, 3) the facility would not be classified as a major source under the New Source Review or operating (Title V) air-quality permit programs which were described in the GEIS (NRC, 2009). As noted in GEIS Section 4.4.6, the entire NSDWUMR is an attainment area for NAAQS (see SEIS Section 3.7.3).

These three conditions do describe the proposed Ross Project area. The Ross Project would be designed to ensure that its emissions are within regulatory limits and requirements; it would be located in the NSDWUMR which, as described in SEIS Section 3.7.3, is an attainment area for all NAAQS primary pollutants (i.e., is in compliance with NAAQS) (see Table 3.17 in SEIS Section 3.7.3); and, the Ross Project would not be classified as a major air-emissions source under New Source Review or Title V of the CAA. The Ross Project also would not impact the nearest prevention of significant deterioration (PSD) Class I areas. These conditions would apply to all phases of the Ross Project.

4.7.1.1 Ross Project Construction

Generation of fugitive dust during land-disturbing activities conducted during ISR facility construction would be the same as discussed in GEIS Section 4.3.6.1, and would be short-term. Other air-quality impacts from fugitive dust would result from road dust being suspended by moving vehicles over nearby and Ross Project roads as well as from construction equipment while it is used to clear and grade portions of the Project area where construction would occur. During the Proposed Action's construction phase, the Applicant estimated a disturbance area of 113 ha [280 ac] during construction of Ross Project buildings and auxiliary structures, surface impoundments, access roads, and other infrastructure. Traffic associated with the Ross Project would use the primary access route of New Haven Road or D Road, which are paved, such that impacts, including fugitive dust generation, would be limited to more occasional access on local dirt roads within the Ross Project area.

Fugitive dust and other particulate emissions are regulated under the *Wyoming Air Quality Standards and Regulations* (WAQSR), Chapter 3, Section 2(f), "Fugitive Dust." The WAQSR quantifies opacity and emission-specific constituent concentrations that apply exclusively to any point sources at the Ross Project (e.g., combustion engines) (WDEQ/AQD, 2011). In contrast to point sources, WDEQ/Air Quality Division (AQD) also regulates generalized fugitive-dust emissions by imposing BMPs rather than numerical limits.

In a study of air-quality impacts of road construction, Roberts et al. (2010) found that near-road pollutant concentrations decline substantially within 100 – 150 m [330 – 490 ft] of the road, and they can reach background conditions at approximately 300 – 500 m [980 – 1,600 ft] from the road (Roberts, 2010). Similarly, a study by Countess et al., undertaken to improve the modeling of windblown and mechanically re-suspended fugitive-dust emissions, found that not all particles that could be suspended are in fact transported long distances; this is due to deposition rates, vertical mixing, and transport times. Countess found that PM_{10} (less than 10 μm in diameter) particulates (i.e., dusts) deposit relatively quickly at a rate of 0.5 – 5 cm/s [0.2 – 2 in/s]; $PM_{2.5}$ particulates deposit more slowly at 0.05 – 0.2 cm/s [0.02 – 0.08 in/s], with a continuum of values between these two extremes for cropland, prairie land, and paved surfaces. In general, the fraction of the mechanically generated fugitive dust from roads and bare surfaces that is removed from the atmosphere by gravitational settling and by impacting nearby obstacles (such as vegetation) is much larger than that associated with fugitive windblown dust. This is because of the fact that the mechanically-generated particulates tend to remain closer to the ground for longer periods after suspension in the air than windblown dusts, such that there is a higher probability that these mechanically generated particles, such as those generated by vehicles, are removed from the atmosphere close to their sources.

Windblown fugitive-dust emissions can be lofted vertically to great heights above the ground by the sustained energy provided by the vertical component of the wind, especially for strong winds, and consequently, can be transported much longer distances from their sources than mechanically generated fugitive-dust emissions. A typical wind speed of 2.5 m/s [8 ft/s] results in the transport of particulates to 100 m [330 ft] in 40 seconds, 1,000 m [3,300 ft] in 400 seconds (or approximately 7 min), and 10,000 m [33,000 ft] in 4,000 seconds [1.1 hr]. In general, PM_{10} particulates are deposited at a rate that is about an order of magnitude greater than $PM_{2.5}$ because of the greater gravitational settling velocity (Countess, 2001). These data indicate that the majority of fugitive-dust impacts would not extend beyond the 80-km [50-mi] radius around the Ross Project area, although winds with large vertical components can transport dust over longer distances when they occur. This physical phenomenon is a *de facto* mitigation measure

The greatest combustion-engine gaseous emissions from diesel- and gas-powered equipment operation would occur primarily during the construction and decommissioning phases of the Ross Project because of the equipment used during those phases. To determine the potential air-quality impacts from the passenger vehicles of the commuting workforce as well as delivery and shipment trucks to and from the Ross Project area, the Applicant provided the anticipated number of passenger vehicle trips to and from the Ross Project during each of the Ross Project's phases (see Table 4.2) (Strata, 2011a; Strata, 2012a). The Applicant also estimated the number of each type of supply, product, and waste shipment during each phase. Finally, the Applicant estimated the annual operating time of these vehicles and other construction equipment (Strata, 2011a).

All of this information is important when modeling air-quality impacts, as the Applicant did for each phase of the Proposed Action. In its air-quality modeling results, the Applicant provides (primarily diesel) combustion-engine emission and fugitive-dust estimates. These modeled emissions are provided in Table 4.4 for each phase of the Ross Project (Strata, 2011c; Strata, 2011a). In the NRC's evaluation, the assumptions used by the Applicant in its air-quality modeling efforts were conservative (e.g., each worker was assumed to commute to and from the Ross Project area alone). All emission levels were estimated to be below the major-source threshold for NAAQS attainment areas.

In order to determine impacts to air quality from diesel combustion emissions, the GEIS (NRC, 2009) reported emissions for the ISR facility in Crownpoint, New Mexico, as described in the NRC's Environmental Impact Statement (EIS) for that facility (NRC, 1997). Therefore, emissions from the Crownpoint ISR facility were examined for relevance to the Ross Project. Estimated maximum production of the Ross Project and Crownpoint are both 3 million pounds per year. The estimated gaseous particulate and gaseous emissions were presented in the Crownpoint EIS and in Table 2.72 of the GEIS. The results of the Crownpoint preliminary emissions inventory were similar to the Ross Project, with the exception of particulate matter (PM). PM emissions associated with the Crownpoint facility were approximately 10 T/yr, while combustion and fugitive PM emissions for the Ross Project were estimated at 177 T/yr. In addition, estimated combustion emissions for the Ross Project were significantly higher than those presented in the Crownpoint EIS. The differences can be attributed to the source of emissions factors (AP-42 emission factors were used in the Ross Project, which are significantly more conservative than the assumptions used for the Crownpoint analysis) as well as the estimated operating hours associated with each piece of equipment. The depth to ore deposits is greater at the Ross Project site than at Crownpoint, which would require that the equipment to reach the ore at the Ross Project would be operated for longer time periods and thus create more emissions.

Table 4.4
Non-Radioactive Emissions Summary

Construction Equipment and Truck Tailpipe Emissions (t/yr [T/yr])

Phase	TOC	NO_X	CO	PM_{10}	SO_2	CO_2
Construction	13.27 [12.04]	181.77 [164.90]	39.50 [35.83]	11.89 [35.83]	10.83 [8.82]	7,014.9 [6,363.8]
Operation	3.09 [2.80]	38.78 [35.18]	8.36 [7.53]	2.75 [2.49]	2.56 [2.32]	1,438.6 [1,303.3]
Aquifer Restoration	1.8 [1.63]	22.7 [20.6]	4.9 [4.5]	1.61 [1.46]	1.50 [1.36]	842.6 [764.4]
Decommissioning	5.1 [4.63]	64.3 [58.3]	13.9 [12.6]	4.56 [4.14]	4.25 [3.86]	2,385.0 [2,163.6]

Fugitive-Dust PM_{10} Emissions (t/yr and T/yr)

Phase	Activity	PM_{10} (t/yr)	PM_{10} (T/yr)
Construction Equipment	Site preparation for facility	10.60	11.69
Construction Equipment	Wellfield and roads preparation	15.86	17.48
Construction	Vehicles on unpaved roads	129.40	142.64
Construction	Wind erosion from exposed areas	11.25	12.40
Operation	Vehicles on unpaved roads	13.23	14.29
Operation	Wind erosion from exposed areas	1.03	1.14
Operation	Year five of ISR operation	5.69	6.27
Aquifer Restoration	Vehicles on unpaved roads	8.89	9.80
Aquifer Restoration	Wind erosion from exposed areas	1.03	1.14
Decommissioning	Site preparation for CPP	2.01	2.21
Decommissioning	Wellfield and roads preparation	4.64	5.12
Decommissioning	Vehicles on unpaved roads	70.52	77.73
Decommissioning	Wind erosion from exposed areas	5.79	6.38

Storage Tank Emissions Totals (kg/yr and lb/yr)

Hydrochloric Acid	42.92	47.31
Hydrogen Peroxide	0.98	1.08
Diesel	10.80	11.90
Gasoline	1,176.99	1,297.41

Source: Strata, 2011a; Strata, 2011b.

Note: t = Tonnes, or Metric tons.
T = Short tons, or U.S. tons.

The annual average particulate concentration at Crownpoint was estimated to be less than 2 percent of the Federal $PM_{2.5}$ ambient-air standard, less than 1 percent of the previous Federal and current Wyoming PM_{10} ambient-air standards, and less than 2 percent of the Class II PSD allowable increment. However, this estimate for annual average particulate concentration did not categorize the particulates as PM_{10} or $PM_{2.5}$. The annual average SO_2 concentration was estimated in the Crownpoint analysis to be less than 1 percent of both the Federal and the Wyoming ambient-air standards and less than 1 percent of the Class II PSD allowable increment. Finally, the annual average NO_2 concentration at Crownpoint was estimated to be slightly over 2 percent of the Federal and Wyoming ambient-air standards, but less than 9 percent of the Class II PSD allowable increment. Therefore, although PM emissions at the Ross Project could exceed those at Crownpoint, the low percentages of the ambient air quality standards estimated for the Crownpoint facility emissions indicate that the Ross Project emissions would also be below NAAQS and PSD standards.

Additionally, the meteorology used at the Crownpoint site to estimate average annual air concentrations of emitted pollutants is more stable than at the proposed Ross Project site, based on review of wind stability classes. At Crownpoint, winds that fall into stability classes E and F occur over twice as frequently as winds in stability classes E and F at the Ross Project site. Good dispersion conditions (stability classes A through D) occur approximately 80 percent of the time at the Ross Project site versus approximately 55 percent of the time at the Crownpoint site. Based on the information reviewed, the dispersion conditions at the Ross Project site are more favorable than at Crownpoint and would therefore help to reduce the impacts due to PM emissions.

The Applicant proposes several onsite best available control technology (BACT) mitigation measures as well as many BMPs to control fugitive dust (e.g., fugitive dust would be minimized by the Applicant's wetting soils down during earth-disturbing activities). The Applicant's mitigation of fugitive dust from roads would also include setting appropriate speed limits for vehicle traffic, strategically placing water load-out facilities near access roads, using chemical dust suppressants (e.g., magnesium chloride), encouraging employee carpooling, and selecting road surfaces that would minimize fugitive dust. The placement of soil stockpiles on the leeward side of hills and the Applicant's prompt revegetation of disturbed areas would also reduce the potential for fugitive dust.

In addition, mitigation of all types of impacts to air quality, actual particulate- and gaseous-emission concentrations from the Ross Project area, would be required to be monitored and to comply with the conditions of the WDEQ-issued Construction Air Quality Permit No. CT-12198 (WDEQ/AQD, 2011). The gaseous-emission controls that the Applicant must employ during the Ross Project are outlined in its Air Quality Permit Application, which becomes part of the Air Quality Permit itself (Strata, 2011c). As specified, gaseous emissions would be controlled by the BACT for critical air-emission sources, such as acid-fume scrubbers on acid storage tanks (Strata, 2011c). Other BACTs are listed in the regulations implementing the CAA (40 CFR Subpart C).

The Applicant also plans to use visual observation on at least an hourly basis to monitor air quality in the Ross Project area and on a twice-daily basis at locations along the primary access route leading to the Ross Project. Further, to ensure compliance, the WDEQ/AQD would conduct regular inspections as well as unannounced inspections of permitted facilities (Strata, 2012a). Finally, the Applicant would respond aggressively to any dust-related concerns expressed by its employees, contractors, or members of the public (Strata, 2012a). Given the predominant winds (in terms of both speed and direction) in the region, the remote location of the Ross Project area, and the BACT controls and BMPs that the Applicant is required by its Air Quality Permit to implement, many of the air emissions impacts from the Proposed Action would be fully mitigated (WDEQ/AQD, 2011). Because construction at the Ross Project would be typical of ISR facilities considered in the GEIS, anticipated gaseous-emission and fugitive-dust impacts would be limited in duration during the construction phase, and they would be mitigated. Therefore, the impacts of the Proposed Action on air quality during the construction phase would be short-term and SMALL.

4.7.1.2 Ross Project Operation

Air-quality impacts during the Ross Project's operation phase could include the same as those identified earlier for the construction phase of the Proposed Action (i.e., fugitive-dust and gaseous combustion-engine emissions), and they would be generated by many of the same sources. Estimates for these sources are provided by project phase in the Applicant's Air Quality Permit Application and are summarized here in Table 4.4 (Strata, 2011c).

Impacts from fugitive-dust and gaseous combustion-engine emissions during the operation phase would be less than the construction phase impacts, however, because fewer vehicles would be in use on or near the Ross Project area. Worker commutes would be approximately 60 workers during the operation phase (less than the 200 during construction). Construction-equipment operation (where most portions of the Ross Project area would have been cleared and graded during construction, so little earth movement would occur during operation—only the installation of wellfields would continue to generate fugitive dust) would diminish substantially, thus generating less fugitive dust and gaseous emissions.

Several point sources could release emissions while the Ross Project is in its operation phase. These point sources of gaseous emissions would be located at the CPP. These would include process-pipeline, process-vessel, and storage-tank vents; emergency generators and space heaters; and other sources such as storage vessels and tanks containing acids and bases (Strata, 2011a). Gaseous emissions from the yellowcake dryer are not expected because of the design of the proposed Ross Project's yellowcake circuit, which would include the BACT design of an indirect heat source as well as an integrated filter and condenser.

Gaseous emissions could also be released during the venting of excess vapor pressure from pipelines within the CPP, with small amounts of chemical vapor released. According to GEIS Section 4.4.6, excess vapor pressure in pipelines could be vented at various relief valves throughout the system. These emissions would be rapidly dispersed into the atmosphere, resulting in SMALL impacts (NRC, 2009). In addition, there could also be gaseous emissions during resin transfers or during resin elution (e.g., liquefied oxygen or carbon dioxide that come out of solution). The GEIS determined that a low volume of gaseous emissions would be released during resin transfer and elution at an ISR facility.

The Applicant's refilling of acid, sodium carbonate, or bicarbonate tanks would produce only small quantities of emissions; nonetheless, during the process of refilling the acid storage tanks, the BACT standard of a closed-loop system, which routes displaced vapors back to the tank truck during transfer, would be used (Strata, 2011c). The tanks would be located away from other chemical-storage tanks and away from the process vessels at the chemical-storage area (Strata, 2011b). Any emissions would be scrubbed for acid vapors prior to release to the atmosphere. Sodium carbonate and sodium bicarbonate would be delivered dry by truck and be blown into a storage silo; the vent of this silo would be filtered with a dust-vent bag to capture particulate emissions (Strata, 2011). The emissions from other storage vessels and tanks are summarized by the Applicant in its license application and additional information it has provided the NRC (Strata, 2011a; Strata, 2011b; Strata, 2012a) as well as in its Air Quality Permit Application (Strata, 2011c).

An emergency generator would be required to supply power to critical process equipment in the event of a power failure. The Applicant's Air Quality Permit restricts the generator's operation to 500 hours per year (WDEQ/AQD, 2011). Strata's Air Quality Permit Application provides a summary of generator emissions. Emissions from the vacuum dryers and space heaters in the CPP (natural-gas-burning equipment) are also listed in the emissions inventory (Strata, 2011c). Table 4.4 summarizes the Applicant's estimates of gaseous and particulate emissions, including from the point sources above, as they were modeled for the Air Quality Permit Application (Strata, 2011c).

Other types of air-quality-impact mitigation measures include gaseous-emission control systems that minimize emissions, BMPs that have demonstrated success at controlling emissions, and BACT engineering controls that reduce airborne emissions as well as minimize the potential for accidental releases. For example, powdered-form chemicals that would be delivered to the Ross Project would be delivered in covered trucks and unloaded through sealed pathways into tanks vented through dust-vent bags or fabric filters. Earth-moving and excavation activities would be governed by BMPs to minimize fugitive dust from disturbed areas, such as the Applicant watering dry soils thoroughly during such activities. To ensure that all requirements of the Air Quality Permit are being met, WDEQ/AQD would conduct regular inspections and unannounced visits of the Proposed Action (Strata, 2012a).

During operations, the Applicant will be required to monitor the effluent and selected environmental media to establish the impacts. Thus, the air-quality impacts of the Proposed Action during the operation phase would be SMALL.

4.7.1.3 Ross Project Aquifer Restoration

According to GEIS Section 4.4.6, potential nonradiological air-quality impacts during the aquifer-restoration phase of an ISR facility would include combustion-engine and fugitive-dust emissions from many of the same sources identified during the construction and operation phases. These impacts were found to be SMALL.

During the aquifer-restoration phase of the Proposed Action, the plugging and abandonment of injection and recovery wells would begin after a wellfield has undergone restoration and has met its ground-water quality goals. The emissions associated with the related equipment would be limited in duration and result in small, short-term effects. Vehicular traffic during the aquifer-restoration phase would be limited to delivery of supplies and commuting personnel; however, the workforce at the Ross Project would decrease to 20 during aquifer restoration and, consequently, the vehicular emissions of commuting traffic would substantially decrease. A significant decrease in the frequency of offsite yellowcake shipments would also occur as aquifer restoration proceeds. Thus, the emission-generating activities during the aquifer-restoration phase would be many fewer than during either the construction or operation phases. Therefore, air-quality impacts of aquifer restoration would be SMALL.

4.7.1.4 Ross Project Decommissioning

According to Section 4.4.6 of the GEIS, potential air-quality impacts during an ISR facility's decommissioning phase include fugitive dust, vehicle emissions, and the combustion-engine emissions from many of the same sources identified for the earlier phases of the facility's lifecycle (NRC, 2009). At the Ross Project, in the short term, emissions could increase, especially particulates, because decommissioning of the ISR facility would generate fugitive dust and the related construction equipment would also generate some gaseous emissions. The Applicant's dismantling and demolition of Ross Project buildings, structures, surface impoundments, and process equipment; its excavation and removal of any contaminated soils; its relocation of construction equipment to the different areas where decommissioning activities would take place; and its grading and re-contouring of the site during reclamation and restoration would produce particulate matter that would impact air quality. Combustion-engine gaseous emissions would also be generated by not only construction vehicles, but also vehicles transporting workers to and from the Ross Project (an additional 70 workers would be employed at the Ross Project during its decommissioning phase) (Strata, 2011a). Truck traffic related to the shipment of demolition and other wastes would also increase during the decommissioning phase as the wastes are shipped to various disposal facilities. However, the truck traffic would be only approximately 40 percent of that during the construction phase.

All of the respective mitigation measures identified for the other phases of the Proposed Action would continue to be implemented by the Applicant during decommissioning. Consequently, the overall decommissioning-phase impacts would be similar to or less than construction-phase impacts; therefore, decommissioning phase impacts would be SMALL.

4.7.2 Alternative 2: No Action

Under the No-Action Alternative, the Ross Project would not be licensed and the land would continue to be available for other uses. However, the Applicant could choose to continue with some preconstruction activities, such as its abandonment of exploration drillholes and its data collection and monitoring of the area. These activities would be similar to or of smaller scale as those activities currently occurring at the Ross Project area. These activities would require some equipment and vehicular access to the Ross Project area, which would result in small fugitive-dust and gaseous emissions. Other potential sources of air-quality impacts in the region (including oil-production activities) would continue as well, where emission releases from oil-recovery activities within the area could result from accidental pipe breaks or equipment and infrastructure-system failures. All of these potential emissions would be limited and short term. Thus, the air-quality impacts would be SMALL for the No-action Alternative.

4.7.3 Alternative 3: North Ross Project

Under Alternative 3, the North Ross Project would generally be the same as the Proposed Action, except that the facility (i.e., the CPP, associated buildings, and auxiliary structures as well as the surface impoundments) would be located to the north of where it would be located in the Proposed Action, as described in SEIS Section 2.1.3. At the north location, a CBW would not be required. Therefore, the incremental contribution to air quality impacts that would result from the construction and partial removal of the CBW would not occur under Alternative 3. However, additional construction activities in Alternative 3, such as greater land disturbance due to surface-impoundment construction due to the north site's topography, would be somewhat greater than those in the Proposed Action. The air quality impacts associated with these activities are not significant relative to the air quality impacts that would occur due to the activities that these two alternatives have in common. Therefore, the air-quality impacts of Alternative 3 would be expected to be similar to the air-quality impacts of the Proposed Action. Thus, the air-quality impacts of Alternative 3 would be SMALL.

4.8 Noise

The Proposed Action will generate noise during all phases of the Project's lifecycle. As noted in GEIS Section 3.3.1, most ISR facilities are proposed for undeveloped rural areas at least 16 km [10 mi] from the nearest communities. However, as described in SEIS Section 3.2, there are eleven residences within the surrounding 3 km [2 mi] radius of the proposed Ross Project. Four of these residences are located within 300 m [1,000 ft] of the Ross Project's boundary. The GEIS indicates that 300 m [1,000 ft] is the distance outside of which noise from construction activities will return to background. The nearest two residences of the four within 300 m [1,000 ft] of the Project are 210 m [690 ft] and 250 m [835 ft] from the Project's boundaries and 800 m [2,500 ft] and 1,700 m [5,600 ft] from the proposed location of the CPP and surface impoundments (i.e., the facility) (see SEIS Figure 3.3). There are no sensitive areas, such as schools, churches, synagogues, or mosques or community centers, located less than 300 m [1,000 ft] from the Ross Project's boundaries (Strata, 2011a). There are no residences within the Project area itself.

As described in SEIS Section 3.3, the primary access routes to or from the Ross Project area would be from I-90 north on either D or New Haven Roads (Strata, 2011a). As noted in SEIS Section 3.8, both of the two nearest residences to the Ross Project are located along New Haven Road. Truck traffic, in particular bentonite hauling from the Oshoto bentonite mine 5 km [3 mi] north of the Ross Project area and, less frequently, livestock hauling, are the main contributors to existing traffic noise on D and New Haven Roads. Two noise studies were conducted by the Applicant to establish the baseline noise levels in and around the Ross Project area (see SEIS Section 3.8). One study measured baseline noise with a sound-level meter at two of four nearby residences (i.e., the nearest offsite "receptors"). Pre-licensing baseline noise levels at these residences averaged between 35.4 and 37.4 dBA, depending upon simultaneous factors such as wind speed, traffic volume, vehicular speed, and the type of load being transported (Strata, 2011a). The Applicant's second noise study collected baseline noise level data at its Field Office in Oshoto, 15 m [50 ft] away from New Haven Road and adjacent to the Ross Project area (see Figure 3.1 in SEIS Section 3.2). The latter study demonstrated that the average, daily duration of noise levels above 55 dBA at the Field Office was 62 minutes per day (Strata, 2011a). This noise was attributed to traffic, because of the Office's close proximity to New Haven Road. The EPA identifies noise at or greater than 55 dBA, with a margin of safety determined to protect hearing, as causing outdoor activity interference and annoyance. The EPA identifies noise at or greater than 45 dBA, with a margin of safety determined to protect hearing, as causing indoor activity interference and annoyance (EPA, 1978).

4.8.1 Alternative 1: Proposed Action

Alternative 1, the Proposed Action, consists of four phases: construction, operation, aquifer restoration, and decommissioning of a uranium-recovery facility and wellfields. At the Ross Project, impacts from noise could be a result of vehicular traffic, such as those from commuter vehicles; deliveries of supplies, materials, and equipment; and shipments of yellowcake and wastes within and outside of the Ross Project area. In addition, equipment operation, such as trucks and other heavy pieces of construction equipment, as well as smaller equipment, such as pump jacks and compressors, and wellfield and CPP operation could be sources of noise. Both humans and wildlife are defined as potential receptors in the vicinity of the Ross Project area.

4.8.1.1 Ross Project Construction

The GEIS (Section 4.4.7.1) stated that because of the use of heavy equipment (e.g. bulldozers, graders, drill rigs, compressors), potential noise impacts would be greatest when an ISR facility is being built (NRC, 2009). This section of the GEIS concluded that the noise impacts during construction would be SMALL to MODERATE, where facility construction and wellfield installation would be expected to have only SMALL and temporary noise impacts for residences or communities that are located more than about 300 m [1,000 ft] from noise-generating activities. The MODERATE rating would be limited to temporary noise impacts to the very nearest residences traffic (NRC, 2009).

Table 4.5 indicates the noise levels that have been calculated for the different types of construction equipment planned for use at the Proposed Action, at three different distances: 15 m [50 ft], which would represent nearby workers; 210 m [690 ft], which would represent the residence nearest the Project's boundary; and 762 m [2,500 ft], which would represent the residence nearest the Ross Project's proposed CPP (Strata, 2011a).

Table 4.5
Respective Noise Levels of Construction Equipment

Equipment Type	Noise Level[a] (15 m [50 ft]) (dBA)	Noise Level[b] (210 m [690 ft]) (dBA)	Noise Level[c] (762 m [2,500 ft]) (dBA)
Heavy Truck	82-96	59-73	24-38
Bulldozer	92-109	69-86	34-51
Grader	79-93	56-70	21-35
Excavator	81-97	58-74	23-39
Crane	74-89	51-66	16-31
Concrete Mixer	75-88	52-65	17-30
Compressor	73-88	50-65	15-30
Backhoe	72-90	49-67	14-32
Front Loader	72-90	49-67	14-32
Generator	71-82	48-59	13-24
Jackhammer/Rock Drill	75-99	52-76	17-41
Pump	68-80	45-57	10-22
Drill Rig[d]	52-74	29-51	18-40

Source: NRC, 2009b; Strata, 2011a.

Notes for Table 4.5:
a = Taken from the GEIS.
b = Minimum distance between the Ross Project's boundary and nearest residence.
c = Minimum distance between the CPP and nearest residence.
d = Based upon Strata's 2010 noise study.

Heavy equipment operation within the Ross Project area would peak during the Applicant's construction of the CPP, surface impoundments, wellfields, and associated infrastructure. The majority of construction equipment would only be operated during daylight hours, and these activities would be more than 300 m [1,000 ft] from the nearest residences; thus, associated noise would not exceed the 24-hour average sound-energy guideline of 70 dBA or the daytime average of 55 dBA, the level EPA identifies as protective against interference of receptor activities and receptor annoyance, with a margin of safety determined to protect hearing (EPA, 1978). The noise impacts to nearby residents due to heavy equipment operation would thus be SMALL. Impacts to workers during the Ross Project's construction would be SMALL, because the Applicant would comply with Occupational Safety and Health Administration (OSHA) regulations concerning noise. Further, a Hearing Conservation Program would be conducted by the Applicant, which would require assessment of noise exposures, provision of hearing protection when noise levels exceed the daily permissible exposure levels, performance of periodic audiograms, and stipulation of worker training regarding noise and hearing, all consistent with 29 CFR Part 1910.95.

Impulse or impact noises from certain equipment, such as impact wrenches and pneumatic attachments on rock breakers, could be particularly annoying to residents. These types of equipment could be present during some construction activities of the Proposed Action. However, the primary locations of these noises would be at least 335 m [1,100 ft] from the nearest residence, significantly reducing their perception by residents. The average noise at residences resulting from equipment-related impact or impulse noises would not be expected to reach the 55 dBA nuisance level (Strata, 2012a). Thus, the impacts of impulse noise would be SMALL.

Indoor noise levels due to outside activities typically range from15 to 25 dBA lower than outdoor levels, depending on whether windows are open or closed. With windows open during daytime hours, indoor noise levels could be have the potential to be greater than the average 55 dBA outdoor level that the EPA defines as preventing receptor activities, interfering with their lives, and annoying them, largely because of truck traffic (EPA, 1978). However, since distances would be greater than 300 m [1,000 ft] from ongoing construction activities, potential indoor noise impacts would be SMALL.

Approximately 85 percent of the overall construction workforce would commute during the daytime (Strata, 2012a), where such commutes would occur to and from the Ross Project in single-occupant cars. Additional traffic would occur due to the relocation of construction equipment to and from the Ross Project area. Noise resulting from vehicle and truck traffic could occasionally be annoying to residents within 300 m [1,000 ft] of noise sources at the Proposed Action, particularly during nighttime hours. However, the Applicant estimates that 90 – 95 percent of all deliveries of supplies, materials, process chemicals, and equipment would occur during daytime hours. Because the county roads to and from the Ross Project area currently have very low average daily and annual traffic counts, there would be a high relative increase in vehicular traffic and, thus, noise impacts to nearby residents would be MODERATE; the more distant local communities would experience only SMALL, temporary impacts.

Elevated noise levels associated with construction activities could also affect wildlife behavior onsite. For example, continuous elevated noise levels could reduce the breeding success of the Greater sage-grouse, if the birds were located near construction equipment, making it more difficult for the female sage-grouse hens to locate and respond to the vocalizations of the males. In general, however, wildlife would likely avoid the areas where noise-generating activities are ongoing (see SEIS Section 4.6). Thus, noise impacts to wildlife would be SMALL.

To minimize noise impacts to all receptors, the Applicant proposes additional mitigation measures. For example, the USDOT reports that, for heavy trucks, speeds of 80 – 160 km/hr [50 – 100 mi/hr] result in noise levels of 80 – 97 dBA, while noise levels of 62 – 74 dBA result when passenger vehicles travel within the same speed range (USDOT, 1995). On rough roads, noise levels would be higher. Therefore, the speed limits for onsite and local county roads are a component of the Applicant's planned mitigation of noise impacts. Traffic-related noise impacts would be minimized by the Applicant's working with Crook County to implement and enforce additional speed limits on the roads as well as to develop its own speed-limit policy for employees and contractors. Regular maintenance of all road surfaces to avoid ruts, potholes, and uneven wear patterns would also minimize noise impacts from vehicle and truck traffic.

The presence of vegetation and topographic features between the noise-generating activity and the receptor would reduce noise levels even more (Countess, 2001). The large topographic features that exist in the Ross Project area (i.e., steep hills and ridges) between the noise-generating construction activities and the nearest receptors would act as barriers to noise propagation. Mitigation measures that would be implemented by the Applicant would include nighttime drilling restrictions within a specified distance of residences, daylight-hour use of construction equipment, "first move forward" driving policies to limit backup alarms from trucks, and speed limit enforcement on access roads. The Applicant would also limit the use of equipment with loud engines, unrestricted exhaust systems, and compression brakes (Strata, 2011a).

Thus, the noise impacts during the Proposed Action's construction would be SMALL to MODERATE, where only the closest residents to the Ross Project would experience MODERATE, but short term, exposures to noise.

4.8.1.2 Ross Project Operation

As noted in GEIS Section 4.4.7, the noise impacts of an ISR facility during the operation phase would be SMALL to MODERATE (NRC, 2009). Truck traffic would be present during the Proposed Action's operation phase and would be associated with yellowcake, vanadium, and waste shipments (16 trucks would be expected during operation vs. 24 during construction). Commuter-traffic noise would decrease because of the smaller workforce required during ISR operations (60 workers would commute per day during operation vs. 200 during construction). Thus, traffic noise impacts produced at the Ross Project during operation would be SMALL to MODERATE, but these would be short term and limited to the nearest receptors (i.e., residences).

During the operation phase, most of the Proposed Action's uranium-recovery activities would be conducted inside buildings (although some wellfield activities would take place outdoors) and fewer pieces of heavy machinery would be used. Therefore, the potential noise impacts from the operation of equipment during the operation phase would be less than those discussed under the construction phase and would be SMALL. Noise emanating from the CPP from a variety of mechanical equipment (e.g. generators; pumps; air compressors; and heating, ventilation, and air conditioning systems) is not expected to exceed the 55 dBA nuisance level because the doors to the CPP would be kept closed as much as possible. Since noise levels decrease significantly with distance and because the CPP would be located approximately 760 m [2,500 ft] from the Ross Project boundary, impacts due to noise emanating from the CPP are expected to be SMALL.

As during the construction phase, noise from the Ross Project's operation would have SMALL impacts to wildlife, which would likely avoid areas where noise-generating activities are ongoing. Similarly, health and safety impacts to personnel at the Ross Project would be SMALL because most of the noise associated with construction would no longer take place.

The specific mitigation measures related to noise impacts adopted by the Applicant during Ross Project construction would continue through its operation. Every plant worker would be periodically retrained to understand the hazards of excess noise and how to decrease noise impacts under the hearing conservation program the Applicant would develop.

4.8.1.3 Ross Project Aquifer Restoration

As noted in GEIS Section 4.4.7.1, the overall noise impacts during aquifer restoration would be SMALL to MODERATE (NRC, 2009). However, noise impacts during the aquifer-restoration phase at the Ross Project would be SMALL because truck traffic would subside to only approximately 12 shipments per day, because overall density of residences and receptors near the Ross Project area is sparse, and because the noise-mitigation measures that the Applicant would undertake would minimize noise. All noise impacts would also be temporary. In addition, the workforce employed during aquifer restoration would be smaller (i.e., 20 workers) than that during the construction and operation phases of the Proposed Action and, thus, there would be fewer workers, less traffic, and fewer noise-producing activities. Finally, the Applicant's continued compliance with OSHA noise standards would minimize noise impacts to workers. Wildlife would continue to avoid the areas where noise-generating activities are ongoing (e.g., the wellfields). All of these factors would ensure that the noise impacts during the aquifer-restoration phase of the Proposed Action are SMALL.

4.8.1.4 Ross Project Decommissioning

The GEIS indicated that noise impacts emanating from an ISR facility undergoing decommissioning would be SMALL to MODERATE. At the Ross Project, noise levels during the decommissioning phase of the Proposed Action would be similar to or less than those identified for the construction phase, for both onsite receptors (i.e., workers) and offsite receptors (i.e., nearest residents). Most potential impacts to nearby residences would occur as a result of the increased noise due to commuter and truck traffic to and from the Ross Project area during decommissioning (i.e., 90 workers and additional waste shipments) and would be SMALL to MODERATE.

Many decommissioning activities would be focused at the ISR facility itself (i.e., the CPP, the surface impoundments, and auxiliary structures), where activities would include decontamination, dismantling, and demolition of these structures, which would be accomplished through the use of heavy equipment. However because this area is approximately 762 m [2,500 ft] from the nearest residential receptor, noise impacts to the nearest residents would be SMALL. In the wellfields, equipment used during plugging and abandonment of recovery, injection, and monitoring wells, such as cement mixers, compressors, and pumps, would produce significant levels of short-term noise. Impacts to workers during the Proposed Action's decommissioning would be SMALL, due to the same variables indicated earlier for its construction and operation as well as for aquifer restoration (i.e., OSHA noise-standard compliance). The same is true for wildlife noise receptors, which would avoid the locations where decommissioning activities are taking place.

Despite the standard mitigation measures taken during decommissioning—the same as those identified for the other phases of the Proposed Action—the distance from the closest residences to the Ross Project would cause the noise impacts to be SMALL to MODERATE, but short-term.

4.8.2 Alternative 2: No Action

Under the No-Action Alternative, the Ross Project would not be licensed and the land would continue to be available for other uses. However, the preconstruction activities the Applicant has undertaken, such as the plugging and abandonment of wells, could continue under the No-Action Alternative. Thus, the noise levels within the Ross Project area, where the measured baseline noise levels are 36 to 40 dBA, could continue (Strata, 2011a). This noise would occasionally be elevated by the passing of heavy trucks and passenger vehicles, nearby agricultural activities, and nearby oil-production activities (Strata, 2011a). Thus, the noise impacts of Alternative 2 would be SMALL.

4.8.3 Alternative 3: North Ross Project

Under Alternative 3, the North Ross Project would generally be the same as the Proposed Action, except that the facility (i.e., the CPP, associated buildings, and auxiliary structures as well as the surface impoundments) would be located to the north of where it would be located in the Proposed Action, as described in SEIS Section 2.1.3. However, because the north site of Alternative 3 is farther away from main roads than the south site of the Proposed Action, the north site's nearest residential receptors are farther away than from the location of the south site. Therefore, the noise generated by construction equipment would be even less likely to exceed the 55 dBA nuisance level at the closest residences. Within the fenced facility area itself, the noise levels during construction of Alternative 3 would be similar to those in the Proposed Action because the same types of construction activities would take place.

The noise levels associated with vehicle and truck traffic volume under Alternative 3 would be essentially the same as described for the Proposed Action, because the uranium-recovery activities would be identical to those of the Proposed Action, including the vehicular traffic on county roads. Thus, residents nearest these roads would experience the same noise impacts as described under the Proposed Action. Workers and wildlife would experience the same impacts under this Alternative as in the Proposed Action. Mitigation measures for noise impacts under Alternative 3 would be same as well. Thus, although the impacts from noise associated with Ross Project construction, operation, aquifer restoration, and decommissioning would be slightly lower than those described above for the Proposed Action because of the slightly greater distance to receptors, the noise impacts of the North Ross Project would be SMALL to MODERATE.

4.9 Historical, Cultural, and Paleontological Resources

As discussed in GEIS Section 4.4.8, potential environmental impacts to cultural resources, which are defined in the GEIS as historical, cultural, archaeological, and traditional cultural properties (TCPs), could occur during all phases of an ISR facility's lifecycle (i.e., during construction, operation, aquifer restoration, and decommissioning) (NRC, 2009). As described in SEIS Section 1.7.3.2 and SEIS Section 3.9, the NRC staff's National Historic Preservation Act (NHPA) Section 106 consultation process for identifying and evaluating historical and cultural resources that could be adversely affected by the Proposed Action is still ongoing. Table 3.18 lists the 25 historic and cultural properties that have been identified to-date within the Ross Project area. The NRC staff's evaluations to determine whether these properties are eligible for listing on the National Register of Historic Places (NRHP) are ongoing. Additionally, the Ross Project area is located between mountains considered sacred by various Native American cultures (the Big Horn Mountains to the west and the Black Hills and Devils Tower to the east). Additional sites of Tribal religious and cultural significance, therefore, could potentially be identified during a TCP survey of the Ross Project area that would be conducted by Tribes and that is currently being coordinated by the NRC staff in consultation with the Tribes and the Applicant (see SEIS Section 1.7.3.2). Once more information becomes available regarding the historical and cultural resources that could be adversely affected by the Ross Project and any mitigation measures that would be agreed to by the Applicant to reduce the adverse effects, this SEIS will be revised accordingly.

4.9.1 Alternative 1: Proposed Action

Alternative 1, the Proposed Action, consists of four phases: construction, operation, aquifer restoration, and decommissioning of the Ross Project facility and wellfields. The impacts of the Ross Project would include the potential to disturb or destroy historical, cultural, and paleontological resources, including NRHP-eligible archaeological sites. In general, adherence to strict mitigation measures can avoid or minimize impacts. These measures could include avoidance, where practical, of NRHP-eligible sites through adjustments in the Ross Project's design, timely consultations with Wyoming State Historic Preservation Office (SHPO) and affected Tribes, and mandated protocols when inadvertent discovery(ies) of unrecorded resources are unearthed during ground-disturbing activities. Once site identification and evaluation is complete, mitigation measures to avoid, minimize, or mitigate adverse impacts to historical, cultural, and paleontological resources and to plan for inadvertent discovery of cultural materials or human remains would be developed in consultation with the Wyoming SHPO, the affected Tribes, and the Applicant.

4.9.1.1 Ross Project Construction

Construction of the Proposed Action could disturb up to 113 ha [280 ac], or 16 percent, of the total Ross Project area. As noted in GEIS Section 4.4.8, most of the potential for direct and indirect adverse impacts to NRHP-eligible properties, traditional culturally significant sites, and paleontological materials would likely occur during ground-disturbing activities during construction or decommissioning (NRC, 2009).

Ground-disturbing activities during construction with the potential to destroy the spatial integrity of archaeological sites and to damage artifacts as well as paleontological resources include, but are not limited to, grading or excavation for roads and parking lots; pipes, wells, and wellfields; buildings and structures; domestic-sewage facilities; utility transmission lines and poles; facility lighting; and surface impoundments. Buried archeological and cultural features as well as deposits of paleontological resources that are not visible on the surface during the initial cultural-resource inventories could be exposed during earth-moving activities. Other potential impacts come from compaction of the soil by heavy equipment, causing damage to subsurface site integrity by crushing or scattering artifacts or features.

Certain paleontological specimens have been located at the Ross Project area; however, they are believed not to be in situ (i.e., they had already been disturbed). Ground disturbance in excess of a few feet during construction could have a limited impact on the geological units themselves, including the Lance Formation, which have the potential to contain a variety of fossils. In addition, increased access to surface-evident archaeological sites during construction could result in vandalism. TCPs could be affected by temporary visual and aural intrusions.

The mitigation measures related to historical and cultural resources would include the standard industry practices that are described in GEIS Section 4.4.8. In addition, consultation by the NRC with the Wyoming SHPO, the Tribes, and the Applicant would result in an agreement clearly delineating the measures the Applicant would take to avoid, minimize, or mitigate adverse effects to historical, cultural, and paleontological resources and to plan for inadvertent discovery of cultural materials or human remains. The NRC staff concludes that the impacts to historical and cultural resources at the Ross Project site would range from SMALL to LARGE. This finding reflects the fact that the highest potential for adverse effects to historical and cultural resources would take place during the construction phase, as well as the fact that efforts to identify and evaluate historic and cultural properties and to determine effects and mitigation are incomplete and Section 106 consultation is ongoing.

4.9.1.2 Ross Project Operation

Direct and indirect adverse impacts on archaeological sites, NRHP-eligible historical properties, TCPs, and paleontological resources are expected to be minimal during the operation phase of the Ross Project. Impacts would be mitigated prior to facility construction and Ross Project operation is generally limited to previously disturbed areas (except continuing wellfield installation). Visual or aural impacts from uranium-recovery operation at the Ross Project to traditional cultural resources located within the Ross Project area and other cultural landscapes, which would be identified before construction, would be expected to continue during operation. Therefore, the impacts to historical and cultural resources during Ross Project operations would be SMALL.

4.9.1.3 Ross Project Aquifer Restoration

Impacts to archaeological sites, NRHP-eligible historical properties, TCPs, and paleontological resources from aquifer restoration would be similar to those expected during uranium-recovery operation. These impacts would primarily result from the surface disturbance associated with operation, maintenance, and repair of existing wellfields as part of the aquifer-restoration process as well as on-going visual or aural impacts. Therefore, the impacts to historical and cultural resources during aquifer restoration would be SMALL.

4.9.1.4 Ross Project Decommissioning

Surface-disturbing activities would temporarily increase during the Ross Project's decommissioning. As during construction, ground disturbance in excess of a few feet during facility decommissioning would have an impact on the geological units themselves, including the Lance Formation, which has the potential to contain a variety of fossils. However, most of the decommissioning activities would focus on previously disturbed areas and, therefore, most of the historic, cultural, and paleontological resources would already be known as a result of the investigations that would be conducted prior to construction. Unavoidable visual and aural impacts, however, could increase temporarily during the decommissioning of the Proposed Action. Therefore, the impacts to historical and cultural resources during decommissioning would be SMALL.

4.9.2 Alternative 2: No Action

Under the No-Action Alternative, the Ross Project would not be licensed and the land would continue to be available for other uses. Under the No-Action Alternative, no major disturbance of land and concomitant potential impacts to historic, cultural, and paleontological resources would occur, except for natural processes such as erosion, although some preconstruction activities could potentially disturb historic, cultural, and/or paleontological resources. The impacts to historical and cultural resources under Alternative 2 would be SMALL.

4.9.3 Alternative 3: North Ross Project

Under Alternative 3, the North Ross Project would generally be the same as the Proposed Action, except that the facility (i.e., the CPP, associated buildings, and auxiliary structures as well as the surface impoundments) would be located to the north of where it would be located in the Proposed Action, as described in SEIS Section 2.1.3. Any impacts to historical, cultural, or paleontological resources from the construction, operation, aquifer restoration, and decommissioning of the Ross Project under Alternative 3 could occur as described in the Proposed Action. Therefore, the impacts to historical and cultural resources due to Alternative 3 also would be SMALL to LARGE during construction and SMALL during operation, aquifer restoration, and decommissioning. However, as with the Proposed Action, mitigation measures such as avoidance would be developed prior to construction and would reduce the construction impacts.

4.10 Visual and Scenic Resources

The Proposed Action could impact visual and scenic resources during all phases of the Project's lifecycle. The visual-resources impacts analysis below is an evaluation of the landscape changes that could occur as a result of the Proposed Action. Most of the visual and scenic impacts would be associated with construction activities, which would be short term, as well as with the new buildings and roads, which would exist until all phases of the project are completed. The Ross Project would introduce new elements of form, line, color, and texture into the landscape of the Ross Project area. Because of the small surface footprint (only 113 ha [280 ac]) and low profile of the uranium-recovery facility and wellfields, no major visual or scenic impacts would be expected to occur.

The visual-resources study area for the Ross Project is currently categorized by Strata as a VRM Class III, according to the BLM scale noted in SEIS Section 3.10. Consequently, the level of change to the characteristic landscape in Class III areas can be moderate (BLM, 2010).

4.10.1 Alternative 1: Proposed Action

Alternative 1 consists of four phases: construction, operation, aquifer restoration, and decommissioning of an ISR uranium-recovery facility and wellfields. Potential visual and scenic impacts at the proposed Ross Project could result from earth moving and surface disturbance as well as the construction, operation, and decommissioning of the following: 1) wellfields (including drill rigs, wellhead covers, header houses, and roads); 2) the CPP; 3) the surface impoundments; 4) the CBW; 5) secondary and tertiary access roads; 6) power and utility lines; and 7) fencing. The visual impacts from these site components would, however, be consistent with the BLM VRM Class III designation (NRC, 2009).

4.10.1.1 Ross Project Construction

GEIS Section 4.4.9 noted that visual-resource impacts could result from heavy equipment use (drill-rig masts and cranes), dust and hydrocarbon emissions, and hillside and roadside cuts into the native topography during construction. In addition, construction activities within a rural setting could give the area a more industrial appearance, thereby decreasing the local visual appeal. However, at the proposed site the existing landscape already includes visual alterations as a result of oil recovery, existing roads, and existing utilities. Construction activities would be short term, and following completion of facility construction, many of the areas where temporary ground disturbance has occurred would be reclaimed and restored to the pre-licensing baseline conditions.

The largest visible surface features of the Proposed Action that would emerge during the construction phase would include the CPP and surface impoundments, wellhead covers and header houses; electrical and other utility distribution lines, which are mounted on 6-m [20-ft] wooden poles; and more roads. The Applicant proposes to use both existing and new roads to access each wellfield and the ISR facility itself (i.e., the CPP and surface impoundments) (see SEIS Section 3.10).

Short-term visual contrasts with the characteristic landscape of the Proposed Action would also result from actual activities associated with construction of the Ross Project. Site clearing and grading; facility and surface impoundment construction and wellfield installation; access road construction; vehicular and pedestrian traffic increases; and underground and overhead pipeline and utilities installation all would result in visual contrasts to the color of the Ross Project area. Irregularity of the natural landscape would occur during the construction phase. Construction activities would typically occur during daylight hours and would be consequently visible, with the exception of some drilling and equipment maintenance that could occur at night (Strata, 2011a).

Wellfield construction would involve the use of drill rigs, water trucks, backhoes, supply trailers, and passenger vehicles. This equipment would be temporarily concentrated at each well or wellfield. A typical truck-mounted drill rig can be about 9 – 12 m [30 – 40 ft] tall and would be the most visible piece of equipment used in wellfield construction. Once a well is completed and developed for use, the drill rig would be moved to a new location. Strata anticipates that up to 12 drill rigs could be operated at one time during wellfield construction. As with the construction activities above, drilling would primarily occur during daylight hours; however, it is possible drilling would continue into the night. For nighttime operation, the drill rigs would be lighted, increasing the potential visual impacts.

Additional construction impacts would include visible fugitive dust that would be generated during ground clearing and grading for header houses and drilling pads; access roads and parking lots; storage and laydown pads; the CPP, auxiliary structures, and surface impoundments; injection, recovery, and monitoring wells; and pipelines. In addition, the drill rigs, trucks, and other vehicles employed during the construction phase at the Ross Project could potentially emit visible emissions (see SEIS Section 3.7.3). These impacts would be temporary and short-term. In the long term (i.e., greater than one year), as major construction activities are completed, fugitive dust and vehicle emissions would decrease.

The Applicant would mitigate visual and scenic impacts related to fugitive dust by wetting the soil and using chemical dust suppressants, as necessary, when clearing and grading activities are underway as well as by establishing diminished speed limits for vehicle traffic, strategically placing water load-out facilities near access roads, encouraging personnel to carpool, and selecting road surfaces that would minimize fugitive dust. Following completion of wellfield installation, disturbed areas would be reclaimed and restored within a single construction season, if at all possible (Strata, 2011a). These mitigation measures are discussed in more detail in SEIS Section 4.7.1.1.

The viewshed analysis introduced in SEIS Section 3.10.1 demonstrates that the Ross Project would not be visible from the base of Devils Tower or from the Visitor's Center. The Proposed Action would be visible (as determined by the cross-section shown in Figure 3.21 in SEIS Section 3.10.1) to climbers scaling the Tower. During initial construction, fugitive dust, other emissions, and construction traffic could impact the viewshed for the Devils Tower climbers. As major construction activities are completed, however, fugitive dust and other emissions would decrease. The Ross Project would not be visible from Keyhole State Park, Black Hills National Forest, or Thunder Basin National Grassland during any phase of the Project due to the long distances between these recreational areas and the Ross Project as well as to the screening effects of topography (Strata, 2011a).

The Applicant would mitigate visual impacts during its construction activities by phasing construction activities; limiting the extent of land disturbance at any one time; promptly restoring and reseeding disturbed areas; using existing roads wherever possible; following existing topography during access road construction to minimize cut and fill and thus reduce contrast; minimizing secondary and tertiary access road widths; and locating access roads, pipelines, and utilities in common corridors (Strata, 2011a).

Prior to construction of the Ross Project, baseline monitoring for potential light pollution would be conducted at eight sites. Based on the results of this preconstruction baseline evaluation, a light-pollution monitoring plan would be prepared by the Applicant. This plan would finalize the locations for both continuous and intermittent light sources; in addition, it would provide a schedule for periodic checks on sky brightness during the construction and operation of the Ross Project to ensure worker safety and to measure, and to mitigate if necessary, obtrusive light emanating from the Proposed Action (Strata, 2012a).

The Applicant proposes the following mitigation measures to limit light-pollution impacts at the Ross Project:

- Designing lighting plans with an emphasis on the minimum lighting requirements for operation, safety, and security purposes;
- Using light sources of minimum intensity (as measured in lumens) necessary to accomplish the light's purpose;
- Specifying lighting fixtures that direct light only where it is needed (i.e., shine down, not out or up) in conjunction with shielding that further directs the light towards the respective work area;
- Turning lights off when not needed at proposed intermittent light locations either manually, with timers, or occupancy sensors;
- Adjusting the type of lights used so that the light waves emitted are those that are less likely to cause light-pollution problems such as those attendant with high-pressure sodium lamps;
- Fitting building windows with shutters, where appropriate, to block light emissions, including the CPP and other buildings;
- Using natural and/or in situ screens to reduce perceptible light (i.e., locating buildings and other facility components to take advantage of the natural topography and any trees; and
- Evaluating the results of the light-pollution monitoring to ensure that, as necessary, the mitigation measures suggested previously have been implemented successfully (Strata, 2012a).

Finally, the Applicant is committed to evaluating the extent of the light pollution to nearby residences following installation of the final lighting system. Additionally, the Applicant is committed to acting on any concerns of local residents as long as worker safety is not compromised (Strata, 2012a).

Because the management objective of VRM Class III is to partially retain the existing character of the landscape so that the level of change to the characteristic landscape can be moderate, the impacts from the Ross Project's construction are in fact consistent with VRM Class III. Thus, in the short-term (i.e., less than one year), construction activities at the proposed Ross Project would result in SMALL to MODERATE visual impacts to the nearest four residences, each of which has a view of the Ross Project area. For the remaining 7 of the 11 nearby residences, however, the visual impacts would be SMALL.

4.10.1.2 Ross Project Operation

SEIS Section 2.1.1 describes the Proposed Action's uranium-recovery operation. Most of the wellfield and surface infrastructure would have a low profile, and most piping and cables would be buried. The irregular layout of wellfield surface structures, such as wellhead covers and header houses, would further reduce visual contrast. Because uranium-recovery operations are generally located in sparsely-populated areas, typically in generally rolling topography, most visual impacts during facility and wellfield operation would not be visible from more than approximately 1 km [0.6 mi] away. As described in GEIS Section 4.4.9.2, the potential visual and scenic impacts from uranium-recovery operation are SMALL.

At the Ross Project, wellhead covers and header houses (wellhead covers would be typically low at approximately 1 – 2 m [3 – 6 ft] high), the CPP and auxiliary buildings, the surface impoundments, access roads, buried utilities, and unburied facility lighting and power lines would be similar to those discussed in the GEIS and, therefore, the potential impacts to the visual resources during Ross Project operation would also be SMALL. Most of the pipelines and cables associated with wellfield operation are anticipated to be buried to protect them from freezing; thus, they would not be visible during the Proposed Action's operation. Other potential impacts include the conduct of wellfield activities, such as monitoring-well sampling, module-building inspections, and mechanical-integrity testing; these impacts would also be SMALL. Because the location of the uranium ores underlying the Ross Project are typically irregular, the network of pipes, wells, and power lines (6 m [20 ft] tall) would not be regular in pattern or appearance (i.e., not a grid); this lack of a pattern would reduce visual contrast and associated potential impacts. The overall visual impact of an operating wellfield would be SMALL (NRC, 2009).

Because the uranium-recovery processing and support facilities, such as the CPP, offices, and maintenance buildings, would be located in one area, they would be more noticeable to the casual observer due to their size and density. The CPP would be the largest structure. These components would be prominent in the foreground and middle-ground views, and they would be silhouetted in the background view from public access points (i.e., the adjacent county roads). As described in SEIS Section 3.10, however, the Proposed Action would be located in gently rolling topography, where the visibility of aboveground infrastructure would vary and would be relative, depending upon the location and elevation of an observer as well as on nearby topography, total distance, and lighting characteristics.

Lighting from the Ross Project would be visible from five of the residences to the east and from various locations directly to the west, north, and southeast. Figure 3.22 in SEIS Section 3.10.2 shows where lighting emanating from the Proposed Action would be visible within the 3-km [2-mi] vicinity surrounding the Project area. Mitigation measures for local light-pollution impacts would be the same as those described above for the construction phase of the Ross Project.

In addition to the mitigation measures employed during the Proposed Action's construction phase, the Applicant identifies a number of additional mitigation measures to reduce the visual impacts during its operation. The wellhead-cover color would be selected to blend with the environment. Pipelines and electrical lines between the wells and module buildings would be buried as new wellfields come online, and disturbed areas would be immediately reclaimed, reseeded, and restored. The electrical-distribution poles would be wooden so that the natural color would tend to blend with the landscape. Another mitigation measure for screening the CPP and surface impoundments would include the Applicant's planting trees at a density that would limit views into the Project area from public roads and nearby residences. The tree species would be a conifer or another species native to the area. The approximate tree locations are depicted on Figure 4.3.

Thus, the impacts to visual and scenic resources during the operation of the Proposed Action would be SMALL.

4.10.1.3 Ross Project Aquifer Restoration

GEIS Section 4.4.9 concluded that the visual impacts during aquifer restoration would be similar to those experienced during uranium-recovery operation, and therefore the impacts would be SMALL (NRC, 2009). Much of the same equipment and infrastructure used during Ross Project operation would be employed during aquifer restoration, so that impacts to the visual landscape would be expected to be similar to or less than the impacts during the Proposed Action's operation phase. In the wellfields, the greatest source of visual contrast would be from equipment used as injection and production wells are being plugged and abandoned during the natural sequence of the installation of a new wellfield(s) and restoration of the aquifer in a spent wellfield(s). Because there is no active drilling in any wellfield undergoing aquifer restoration, potential visual impacts during this phase would be expected to be less than those during facility construction and wellfield installation, and these impacts would be of short duration.

The mitigation measures presented for both the Proposed Action's construction and operation phases would continue to be implemented during the aquifer-restoration phase, and these would continue to limit potential visual impacts. Vehicular traffic during the aquifer-restoration phase would be much more limited: worker commutes would diminish significantly (i.e., from a workforce of 200 persons to one of 20 persons during aquifer restoration) and there would be fewer deliveries of supplies. There would also be a decreasing-to-zero frequency of offsite and potential onsite yellowcake shipments as aquifer restoration proceeds. Therefore, fewer trips would occur than during the earlier phases, with concomitant lower levels of fugitive dust and combustion engine emissions as *de facto* mitigation measures.

Because aquifer-restoration activities at the Ross Project would be very similar to those described in the GEIS (NRC, 2009), the impacts of the Project during the aquifer-restoration phase would also be SMALL.

4.10.1.4 Ross Project Decommissioning

As discussed in GEIS Section 4.4.9.4, the impacts on visual and scenic resources during the decommissioning of an ISR facility would be SMALL (NRC, 2009). The Proposed Action would not cause any significant impacts to the landscape that would persist after facility decommissioning and site restoration are completed. Most visual impacts during decommissioning would be temporary and diminish as structures, equipment, and other facility components are removed; the disturbed land surface is reclaimed and restored; and the vegetation is re-established. NRC licensees are required to conduct final decommissioning and site restoration under an NRC-approved decommissioning plan, with the goal of returning the landscape to the visual conditions of the area prior to any NRC-licensed activities. While some roadside cuts and hill-slope modifications could persist beyond facility and wellfield decommissioning and site restoration (depending upon a landowner's wishes), the re-contouring, re-vegetating, and restoring of the Ross Project area would consist of the same activities described in the GEIS and, hence, the visual and scenic impacts from the Proposed Action's decommissioning would be SMALL.

When the Ross Project's decommissioning efforts have been accepted by the NRC, all buildings and equipment would have been decontaminated, dismantled, decommissioned, and either disposed of or relocated to another facility. Site reclamation efforts would be designed to return the visual landscape of the Ross Project to its baseline contours. Re-contouring of disturbed areas on the Ross Project (including access roads) and the reseeding of those areas with native vegetation or an approved seed mix would both be accomplished during site restoration. All of these activities would minimize any permanent impacts on visual and scenic resources.

The Applicant would mitigate the fugitive-dust impacts that could result from decommissioning activities by its use of water spray during dismantling and demolition activities and on unimproved roads to reduce dust emissions (Strata, 2011a). Areas of disturbance would be restored and reseeded to the pre-construction condition. All facility-decommissioning and site-restoration activities would be done in accordance with NRC and WDEQ/LQD guidelines. Once these activities are complete, the visual landscape would have been returned to its pre-construction, pre-operational condition.

4.10.2 Alternative 2: No Action

Under the No-Action Alternative, the Ross Project would not be licensed and the land would continue to be available for other uses. Therefore, there would be no change to the existing visual and scenic resources at the Ross Project area. In general, the existing site conditions and land uses would persist. All existing roads, fences, utilities, landscape formations, and vegetation would remain. No additional structures or land uses associated with the Ross Project would be introduced to affect the existing viewscapes, and the existing scenic quality would be unchanged. The visual resource classification would remain BLM Class III, as described in SEIS Section 3.10. Thus, visual and scenic impacts would be SMALL.

4.10.3 Alternative 3: North Ross Project

Under Alternative 3, the North Ross Project would generally be the same as the Proposed Action, except that the facility (i.e., the CPP, associated buildings, and auxiliary structures as well as the surface impoundments) would be located to the north of where it would be located in the Proposed Action, as described in SEIS Section 2.1.3. The Alternative 3 facility would remain within the Ross Project area, albeit in a location that is more shielded by topographical features than where it would be located in the Proposed Action. Thus, some of the Ross Project views from neighboring properties would be diminished, and the nearby residences would be more shielded from light pollution than they would be under the Proposed Action. As a result, the visual- and scenic-resource impacts would, at the least, not differ from those of the Proposed Action and, most likely, they would be reduced from those of the Proposed Action. Therefore, the visual-resource impacts would be SMALL to MODERATE in the short-term and SMALL in the long-term.

4.11 Socioeconomics

The Proposed Action could impact local socioeconomics during all phases of the Project's lifecycle. During socioeconomic impact analyses, several areas are examined; these include employment, demographics, income, housing, finance, education, and social and health services.

4.11.1 Alternative 1: Proposed Action

Alternative 1, the Proposed Action, consists of four phases: construction, operation, aquifer restoration, and decommissioning of a uranium-recovery facility and wellfields.

4.11.1.1 Ross Project Construction

The Ross Project would employ approximately 200 people during construction (Strata, 2012a). The peak construction workforce of 200 workers is within the range of the construction workforce estimates provided in the GEIS (i.e., also 200 workers) (NRC, 2009). The GEIS assumed that the majority of the construction personnel positions would be filled by skilled workers from outside the NSDWUMR and that this influx of workers would be expected to result in SMALL to MODERATE socioeconomic impacts, with impacts the greatest for communities with small populations (NRC, 2009). However, due to the short duration of construction, the GEIS also noted that these workers would have only a limited effect on public services and community infrastructure. Further, construction workers would be less likely to relocate their families to another region, and if the majority of the construction workforce would be filled from within the region of the facility, socioeconomic impacts would be SMALL (NRC, 2009).

Because the size of the Ross Project's construction workforce is of similar size to that presented in the GEIS, and the Applicant is committed to hiring locally—it projects that 90 percent of the construction workforce would be local hires (Strata, 2012a)—the employment, demographic, income, housing, education, and health and social services impacts during the construction phase of the Ross Project would be SMALL: Employment increases would represent only 1.2 percent of all jobs in the Region of Influence (ROI) (i.e., Crook and Campbell Counties). The population increases, and consequent increases in public and private services, would represent only a 0.1 percent increase over pre-licensing baseline levels. MODERATE impacts are projected for the finance sector as a result of the additional property-tax revenues generated by the Project (see Table 4.6).

Table 4.6
Estimated Major Tax Revenues

Revenue Source	Tax Revenues	
	Average Per Year	Over 10 Years
Severance Taxes	$855,000	$8,550,000
State Royalties	$243,000	$2,430,000
Gross Production Taxes	$1,337,000	$13,370,000
Property Taxes	$350,000	$3,500,000
TOTAL	$2,785,000	$27,850,000

Source: Strata, 2012a.

The following sections provide impact estimates for each of the specific resource areas within socioeconomics during all phases of the Ross Project.

Employment

The 200 construction workers that would be employed at the proposed Ross Project could generate an additional 140 indirect jobs in the ROI (NRC, 2009), for a peak employment impact of 340 workers as a result of the Project's construction phase. With an employment base in the ROI of 28,842 workers (see SEIS Section 3.11.4), impacts on the Region's employment would be SMALL, representing approximately 1.2 percent of all jobs in the two Counties.

Demographics

It is estimated that less than 10 percent of the construction workforce would come from outside the immediate Ross Project vicinity, or approximately 20 workers (Strata, 2012a). As workers could potentially travel from anywhere in the U.S., based upon the average household size of 2.58 for the U.S. (USCB, 2012), this would translate into 52 additional residents in the ROI. It is likely that most new construction workers for the Ross Project would not relocate their families, however for the purposes of this SEIS, it is assumed that they would move their families. This number is less than 0.1 percent of the combined population base of 53,216 persons in Crook and Campbell Counties as of 2010 (see SEIS Section 3.11.1). This would be a SMALL demographic impact.

Income

It is expected that workers would be paid the regional rates typical of Crook and Campbell Counties, where a higher percentage of jobs are in the relatively higher-paying energy industry. Based upon a weighted-average annual earnings per job of $61,400 (see SEIS Section 3.11.2), the 200 workers would generate approximately $12.3 million in annual earnings. With an estimated $2.6 billion in total personal income in both Crook and Campbell Counties, the impacts of the construction of the Ross Project on local income would represent less than 1 percent of total income in the two Counties and would be a SMALL impact.

Housing

According to GEIS Section 4.4.10, the impacts to housing from ISR-facility construction would be expected to be SMALL (and short term), even if the workforce were to be primarily filled from outside the region (NRC, 2009). It is likely, however, that the majority of workers would use temporary housing such as apartments, hotels, or trailer camps (NRC, 2009). At the maximum, if the additional 20 new workers to the Ross Project vicinity represent a demand for 20 housing units in the ROI (see above), this additional demand for housing would represent less than 0.1 percent of the total housing stock of 22,550 units in the region (see SEIS Section 3.11.3), and this would be a SMALL impact.

Finance

As noted in GEIS Section 4.4.10, the construction of an ISR facility could have a MODERATE impact on finances within a ROI (NRC, 2009). Local-government finances would be affected by ISR-facility construction by the additional taxes collected and the purchase of goods and services in support of construction activities. Although Wyoming does not have an income tax, it does have a state sales tax, a lodging tax, and a use tax. Construction workers would contribute to these as they purchase goods and services within the Ross Project ROI, while they work on the construction of the Proposal Action. Based on a valuation of $50 million for the Ross Project facility and wellfields, as well as the related and real property, multiplied by an 11.5 percent assessment ratio and the Crook County mill levy of 0.062545, local property taxes that would accrue to Crook County would be estimated to be approximately $350,000 per year, reflecting approximately 13 percent of Crook County property-tax collections (Strata, 2012a). These benefits would be offset, however, by the cost of additional public services required by the new residents in the vicinity. This additional demand would be associated with just the estimated 52 additional residents in the ROI, representing less than 0.1 percent of the population in the two Counties; the additional cost for public services also would represent less than a 0.1 percent increase in local-government expenditures. Because the size and scale of the Ross Project is similar to that described in the GEIS, and given the foregoing information, the impacts to local finance would be MODERATE.

Education

As discussed above, it is likely that most new construction workers for the Ross Project would not move their families. However, at a maximum, if all 20 workers were to bring their families, and based upon a school-age population representing 20.4 percent of the population nationwide (USCB, 2012), the 52 additional residents in the Ross Project vicinity would generate 11 additional elementary and secondary students in the ROI schools. This would represent less than 0.1 percent of the total enrollment in area schools and would represent a SMALL impact on education.

Health and Social Services

Increased demand for health and social services is a function of the additional population in the ROI. As discussed above, the population increase in the ROI due to construction activities would represent less than a 0.1 percent increase in the local population because most workers would already reside within a commuting radius of the Project. Thus, only a 0.1 percent increase in the demand for health and social services would occur, and this increased demand for such services would represent a SMALL impact.

In addition, as noted in the GEIS, accidents resulting from construction of the Proposed Action would not be expected to be different than those from other types of similar industrial facilities (NRC, 2009). In the case of an industrial accident, the Applicant would commit to maintaining emergency-response personnel on staff and would train local emergency responders in preparing and responding to potential environmental, safety, and health emergencies resulting from Ross Project construction (Strata, 2011a), thereby minimizing any potential decrease in or impact to the availability of local emergency health services.

4.11.1.2 Ross Project Operation

The Ross Project would employ approximately 60 people during its operation (Strata, 2012a). This number is within the range of the operation-workforce estimates provided in the GEIS (50 – 80 workers) (NRC, 2009). According to the GEIS, if the majority of the operation workforce is filled by personnel from outside the area, potential population and public services impacts would range from SMALL to MODERATE, depending upon the proximity of the ISR facility to population centers (NRC, 2009). However, because an outside workforce would be more likely to settle in more populated areas, with increased access to housing, schools, services, and other amenities, these impacts could be reduced (NRC, 2009). If the majority of the workforce during ISR-facility operation is of local origin, the potential impacts to population and public services would be expected to be SMALL (NRC, 2009).

Because the size of the Ross Project's proposed workforce during the operation of the Ross Project would be within the range evaluated in the GEIS, and because the Applicant would commit to hiring locally—80 percent of the operation workforce would be expected to be local hires (Strata, 2012a)—the employment, demographic, income, housing, education, and health and social services impacts during the Ross Project's operation phase would be SMALL. Employment and population increases, and consequent increases in public and private services, would represent less than 1 percent over pre-licensing baseline levels. MODERATE impacts, however, would be projected for finance as a result of the additional tax revenues that would accrue to Crook County (see Table 4.6).

4.11.1.3 Ross Project Aquifer Restoration

The GEIS assumed that the workforce during aquifer-restoration activities at an ISR facility would be the same as the operation phase (i.e., 50 – 80 workers) and, thus, the impacts would be similar and would be SMALL (NRC, 2009). The Applicant indicates that at the Ross Project there would be a workforce of 20 – 30 workers during the aquifer-restoration phase , without concurrent operations (Strata, 2012a), a smaller workforce than that projected in the GEIS.

The need for regulatory, management, and health and safety personnel would continue throughout aquifer restoration, but this need would be met by personnel transitioning from operation-phase work to aquifer restoration, and no new personnel would necessarily be required (Strata, 2012a). Thus, the impacts of the Proposed Action's aquifer-restoration phase would likely be at most the same, or, would more likely be less than those noted for the Ross Project's operation phase. Because the aquifer-restoration workforce at the Project would be less than that estimated in the GEIS, and with an employment base in Crook and Campbell Counties of 28,842 workers (see Section 3.2.10.4), the socioeconomic impacts of the Ross Project on area employment would be SMALL, representing less than 1 percent of all jobs in the two Counties. Severance tax revenues accruing to local jurisdictions would decrease as uranium production ceases during this phase of the Ross Project.

4.11.1.4 Ross Project Decommissioning

In GEIS Section 4.4.10, the workforce examined for an ISR facility's decommissioning was estimated to be similar to that of the construction phase (i.e., up to 200 persons) and, thus, the impacts would be similar and would be SMALL to MODERATE, with MODERATE impacts for areas with small populations (NRC, 2009). The Applicant indicates, however, that about only 90 workers would be required during decommissioning of the Ross Project (Strata, 2011a). Only 12 of these workers would be non-local hires (Strata, 2012a). These personnel generally represent the regulatory, management, and health and safety personnel that would have been present at the Ross Project during the earlier Project phases. Because the size of the workforce for the Ross Project's decommissioning phase is less than that estimated in the GEIS, and only 12 workers would be expected to be non-local hires, the overall socioeconomic impacts of the Proposed Action's decommissioning phase would be SMALL. Tax revenues accruing to local jurisdictions would decrease to zero as uranium production is concluded during decommissioning of the Ross Project.

4.11.2 Alternative 2: No Action

Under the No-Action Alternative, the Ross Project would not be licensed and the land would continue to be available for other uses. There would be no new jobs created; no changes in income levels in the ROI; no changes in population; no increased demand for education, health, or social services; and no changes in local finances. Other forms of energy development in the ROI would continue to impact regional socioeconomic resources. The economic benefits and socioeconomic impacts described for the Proposed Action would not accrue to Crook and Campbell Counties, nor to the State of Wyoming. Thus, the socioeconomic impacts of the No-Action Alternative would be SMALL.

4.11.3 Alternative 3: North Ross Project

Under Alternative 3, the North Ross Project would generally be the same as the Proposed Action, except that the facility (i.e., the CPP, associated buildings, and auxiliary structures as well as the surface impoundments) would be located to the north of where it would be located in the Proposed Action, as described in SEIS Section 2.1.3. The construction of the CPP and surface impoundments at the north site would not change workforce levels, and therefore the impacts would be the same as those described under the Proposed Action. Because changes in employment are the principal driver of socioeconomic impacts, the socioeconomic impacts of Alternative 3 would be the same as for the Proposed Action, SMALL to MODERATE during Alternative 3's construction and operation, and SMALL during aquifer restoration and its decommissioning.

4.12 Environmental Justice

On February 11, 1994, President Clinton signed Executive Order (EO) No. 12898, entitled *Federal Actions to Address Environmental Justice in Minority Populations and Low-Income Populations*, which directs each Federal agency to "… make achieving environmental justice part of its mission by identifying and addressing, as appropriate, disproportionately high and adverse human health or environmental effects of its programs, policies, and activities on minority populations and low income populations" (EOP, 1994).

On December 10, 1997, the Council on Environmental Quality (CEQ) issued its *Environmental Justice Guidance Under the National Environmental Policy Act*. The CEQ developed this guidance to "… further assist Federal agencies with their National Environmental Policy Act (NEPA) procedures." As an independent agency, the CEQ's guidance is not binding on the NRC. However, the NRC considered the CEQ's guidance on environmental justice in developing its own environmental justice analytical procedures (NRC, 2003).

The CEQ provided the definitions listed in the text box to the left in its Guidance for consistent use during environmental-justice analyses (CEQ, 1997).

The NRC has required an environmental-justice analyses be included in its environmental impact statements (EISs) (NRC, 2004; NRC, 2003, Appendix C). NRC environmental-justice guidance discusses the procedures to evaluate potential disproportionately high and adverse impacts associated with physical, environmental,

What is the terminology used during an environmental-justice analysis ?

- ***Low-Income Populations***

These populations are identified by annual statistical poverty thresholds from the U.S. Census Bureau (USCB). In identifying low-income populations, agencies may consider a community as either a group of individuals living in geographic proximity to one another *or* a set of individuals (such a migrant workers or Native Americans), where either type of group experiences common conditions of environmental exposures or impacts.

- ***Minority Individuals***

Minority individuals are those who identify themselves as members of the following population groups: Hispanic or Latino, American Indian or Alaska Native, Asian, Black or African American, Native Hawaiian, or Other Pacific Islander *or* are two or more races, meaning individuals who identified themselves on a Census form as being a member of two or more races, for example, Hispanic and Asian.

- ***Minority Populations***

Minority populations must be identified when the minority population of an affected area exceeds 50 percent *or* the minority-population percentage of the affected area is meaningfully greater than the minority-population percentage in the general population or other appropriate unit of geographic analysis.

- ***Disproportionately High and Adverse Human Health Effects***

Adverse health effects are measured in risks and rates that could result in latent cancer fatalities as well as other fatal or nonfatal adverse impacts on human health. Adverse health effects may include bodily impairment, infirmity, illness, or death. Disproportionately high and adverse human health effects occur when the risk or rate of exposure to an environmental hazard for a minority or low-income population is significant (as determined during NEPA analysis) and appreciably exceeds the risk or exposure rate for the general population or for another appropriate comparison group.

- ***Disproportionately High and Adverse Environmental Effects***

A disproportionately high environmental impact that is significant (as defined by NEPA) refers to an impact or risk of an impact on the natural or physical environment in a low-income or minority community that appreciably exceeds the environmental impact on the larger community. Such effects may include ecological, cultural, human health, economic, or social impacts. An adverse environmental impact is an impact that is determined to be both harmful and significant (as employed by NEPA). In the assessment of cultural and aesthetic environmental impacts, impacts that uniquely affect geographically dislocated or dispersed minority or low-income populations or American Indian tribes are considered.

socioeconomic, health, and cultural resources to minority and low-income populations (NRC, 2004).

4.12.1 Minority and Low-Income Population Analysis for the Ross Project

Demographic and socioeconomic data for the Ross Project area and surrounding communities was assembled to identify minority or low-income populations within a 6-km [4- mi] radius of the area and is shown in Tables 4.7 and 4.8.

Table 4.7 compares race and ethnicity characteristics by census block group to Crook County and Wyoming. The percentage of the population in Wyoming and Crook County that is nonwhite is 9.3 percent and 2.9 percent, respectively (100 percent minus percent white alone equals percent nonwhite). The percentage of nonwhite population that lives in the block groups within a 6-km [4-mi] radius of the Ross Project area ranges from 0.4 – 2.9 percent. In addition, the percentage of the population in Wyoming and Crook County who are Hispanic or Latino is 8.9 percent and 2.0 percent, respectively. The percentage of Hispanic or Latino populations that lives in the block groups within a 6-km [4-mi] radius of the Ross Project area ranges from 1.3 – 4.7 percent. When these numbers are compared to the State and Crook County proportions, they do not exceed the 20-percent level that is commonly considered of environmental-justice significance.

Table 4.8 compares poverty and income characteristics by census tract to Crook County and Wyoming. The percentage of the population living below poverty for Wyoming and Crook County as well as Census Tracts 9502 and 9503 are 9.8 percent, 7.8 percent, 7.2 percent, and 9.0 percent, respectively. When these numbers are compared to the State and Crook County proportions, they also do not exceed the 20-percent level that is considered of environmental-justice significance.
Because no minority or low-income populations, as defined by EO 12898, have been identified in the Ross Project area, no further environmental-justice analysis (Steps 3 – 5) was conducted.

4.12.2 Alternative 1: Proposed Action

Under the Proposed Action, there are no minority or low-income populations identified that are greater than 20 percent within a 6-km [4-mi] radius of the Proposed Action. Therefore, there are no disproportionately high and adverse impacts to minority and low-income populations under the Proposed Action.

4.12.3 Alternative 2: No Action

Under the No-Action Alternative, the Ross Project would not be licensed and the land would continue to be available for other uses. The conditions affecting minority and low-income populations in the vicinity of the Ross Project area would remain unchanged. Therefore, there would be no disproportionately high and adverse impacts to minority and low-income populations under the No-Action Alternative.

Table 4.7
Ross Project Area Race and Ethnicity Characteristics

Area of Comparison	Total	White Alone	% White Alone	Black or African American Alone	% Black or African American	American Indian and Alaska Native Alone	% American Indian and Alaska Native Alone	Asian Alone	% Asian Alone	Hispanic or Latino	% Hispanic or Latino
Wyoming	563,626	511,279	90.7	4,748	0.8	13,336	2.4	4,426	8.2	50,231	8.9
Crook County	7,083	6,884	97.1	14	0.2	48	0.7	11	0.2	141	2.0
Block Group 1 Census Tract 9502	1,211	1,176	97.1	0	0	7	0.6	1	0.1	20	1.6
Block Group 2 Census Tract 9502	1,880	1,843	98	2	0.1	11	0.6	2	0.1	22	1.2
Block Group 3 Census Tract 9502	1,390	1,333	95.9	6	0.4	9	0.6	2	0.1	65	4.7
Block Group 1 Census Tract 9503	1,280	1,171	96.9	4	0.3	8	0.7	5	0.4	16	1.3
Block Group 2 Census Tract 9503	1,394	1,361	97.6	2	0.1	13	0.9	1	0.1	18	1.3

Source: USCB, 2012b (P1 and QT-P4).

Table 4.8 Ross Project Area Poverty and Income Characteristics		
Area of Comparison[a]	Percent Living Below Poverty	Median Household Income
Wyoming	9.8	$53,802
Crook County	7.8	$49,890
Census Tract 9502	7.2	$52,106
Census Tract 9503	9.0	$46,848

Source: USCB, 2012b.
Notes:
a = Income data is not available at the Census-Block-Group level for 2010.
b = Source: USCB, 2012b (S1701).
c = Source: USCB, 2012b (B19013)

4.12.4 Alternative 3: North Ross Project

Under Alternative 3, the North Ross Project would generally be the same as the Proposed Action, except that the facility (i.e., the CPP, associated buildings, and auxiliary structures as well as the surface impoundments) would be located to the north of where it would be located in the Proposed Action, as described in SEIS Section 2.1.3. As there are no minority or low-income populations identified that are greater than 20 percent within a 6-km [4-mi] radius of the Ross Project area under this Alternative, there are no disproportionately high and adverse impacts to minority and low-income populations.

4.13 Public and Occupational Health and Safety

All phases of the proposed Ross Project could result in potential nonradiological and radiological impacts to public and occupational health and safety. Impacts to occupational health and safety could result from both routine exposures to hazardous chemicals and radiation emitted from radionuclides present during uranium-recovery activities, as well as from exposures following an accident. Public nonradiological impacts are unlikely, except under accident conditions. Radiological impacts to the public could occur during both routine Ross Project activities as well as during accidents.

4.13.1 Alternative 1: Proposed Action

Alternative 1, the Proposed Action, consists of four phases: construction, operation, aquifer restoration, and decommissioning of a uranium-recovery facility and wellfields.

4.13.1.1 Ross Project Construction

Proposed construction activities at the Ross Project are very similar to those described in GEIS Sections 4.4.1 and 4.4.11, where the greatest risk to a worker is the inhalation of radionuclides (e.g., radon) during well drilling and installation and inhalation of fugitive dust containing uranium or its progeny during construction activities. The 10 CFR Part 20 public dose limit is 1 mSv/yr [100 mrem/yr] and the 40 CFR Part 190 annual limit is 0.25 mSv [25 mrem]. The corresponding occupational dose limit is 50 mSv [5 rem] for total effective dose equivalent (TEDE) exposures. The GEIS states that an internal exposure to radiation via ingestion is unlikely without substantial intake of the soils and that radiological impacts to both the public and site workers from inhalation of fugitive dust during construction would be SMALL because the radionuclide concentrations would be low (NRC, 2009). The GEIS concluded that the radiological impacts to both the general public as well as construction workers during ISR facility construction would be SMALL.

As described in SEIS Section 2 and consistent with the GEIS, construction activities associated with the Ross Project would include site preparation and the construction of buildings, storage ponds, access roads, wellfields, and other structures and systems. The important radiation exposure pathway during the construction phase would be through direct exposure and inhalation or ingestion of radionuclides during well construction, construction activities that disturb surface soil, and fugitive dust from vehicular traffic during construction. However, the concentrations of these naturally occurring radionuclides are low; for example, the total concentration of uranium in the native surface soils at the Ross Project area is only 0 to 2.80 mg/kg [2.80 ppm] (on the order of 1 – 2 pCi/g). The low concentrations of radionuclides and the atmospheric dispersion of radionuclides in fugitive dust would minimize impacts from exposures to workers. For direct (i.e., gamma) radiation, the public's potential exposure would be equivalent to approximately 5.3 to 25.3 microRoentgens (μR) per hour (μR/hr), which is much lower than the radiation exposure from naturally occurring radionuclides that the public has during day-to-day activities. Thus, the sparse population near the Ross Project area and its vicinity, the lack of public access, the low concentrations of radionuclides, and the atmospheric dispersion of radionuclides in fugitive dust would be sufficient to minimize impacts from any such exposures to the public.

During the Applicant's proposed use of mud-rotary drilling techniques during wellfield installation, some drilling fluids and muds (i.e., cuttings), originating from the ore zone into which the wells would be drilled, would be brought to the surface. This type of well drilling technique involves the use of a drilling fluid that is introduced through the drill's stem, out the drill bit (i.e., end), and then back up to the surface through the drillhole and the drill stem. These fluids and muds would be collected in pre-dug pits near the well being installed. After drying out, the pits would be covered with native topsoil and then re-vegetated (see SEIS Section 2.1.1.5) (Strata, 2011a). However, because these fluids have been passed through the ore-bearing zone, they have the potential to have higher concentrations of naturally occurring radionuclides than do surficial soils. As the discussion of the radiological baseline conditions in SEIS Section 3.12.1 establishes, however, the relative concentration of radionuclides would still be small. Thus, the radiological impacts to the occupational health and safety of workers, including the well-drillers, would also be SMALL.

Construction equipment would likely be diesel powered and would emit diesel exhaust, which includes small particles ($<PM_{10}$). The impacts and potential human exposures from these emissions would be small because the releases are usually short and are readily dispersed into the atmosphere. SEIS Section 4.7 describes in greater detail the potential impacts to air quality from proposed diesel emissions including comparisons with health-based standards. Therefore, the NRC staff concludes that the impact and potential human exposure from these particulate

emissions would be SMALL, consistent with the GEIS conclusions in Section 4.4.11.1 (NRC, 2009).

Thus, the potential impacts to public and occupational health and safety during construction of the Proposed Action are SMALL.

4.13.1.2 Ross Project Operation

Radiological

Normal Conditions

As discussed in GEIS Section 4.4.11.2.1, some amount of radioactive materials will be released to the environment during normal ISR operations. The potential impact from these releases can be evaluated by the MILDOS-AREA computer code (MILDOS), which Argonne National Laboratory developed for calculating offsite facility radiation doses to individuals and populations. MILDOS uses a multi-pathway analysis for determining external dose; inhalation dose; and dose from ingestion of soil, plants, meat, milk, aquatic foods, and water. The primary radionuclide of interest at an ISR facility is radon-222. MILDOS uses a sector-average Gaussian plume dispersion model to estimate downwind concentrations. This model typically assumes minimal dilution and provides conservative estimates of downwind air concentrations and doses to human receptors.

GEIS Section 4.4.11.2.1 presented historical data for ISR operations, providing a range of estimated offsite doses associated with six current or former ISR facilities. For these operations, doses to potential offsite exposure (human receptor) locations range between 0.004 mSv [0.4 mrem] per year for the Crow Butte facility in Nebraska and 0.32 mSv [32 mrem] per year for the Irigaray facility in Johnson County, Wyoming. In each case, the estimated dose is well below the 10 CFR Part 20 annual radiation public dose limit of 1 mSv/yr [100 mrem/yr] (NRC, 2009).

How is radiation measured?

Radiation dose is measured in units of either Sievert or rem and is often referred to in either milliSv/mSv or millirem/mrem where 1,000 mSv = 1 Sv and 1,000 mrem = 1 rem. The conversion for Sieverts to rem is Sv=100 rem. These units are used in radiation protection to measure the amount of damage to human tissue from a dose of ionizing radiation. Total effective dose equivalent, or TEDE, refers to the sum of the deep-dose equivalent (for external exposures) and the committed effective dose equivalent (for internal exposures).

GEIS Section 4.4.11.2.1 also provided a summary of doses to occupationally exposed workers at ISR facilities. As stated, estimated doses at an ISR facility are not dependent on a facility's location and are well within the 10 CFR Part 20 annual occupational dose limit of 0.05 Sv [5 rem] per year. The largest annual average dose to a worker at a uranium recovery facility over a 10-year period [1994–2006] was 0.007 Sv [0.7 rem]. More recently, the maximum total dose equivalents reported for 2005 and 2006 were 0.00675 and 0.00713 Sv [0.675 and 0.713 rem]. Similarly, the average and maximum worker exposure to radon and radon daughter products ranged from 2.5 to 16 percent of the occupational exposure limit of 4 working-level months. NRC staff concluded in the GEIS that the radiological impacts to workers during normal operations at ISR facilities will be SMALL.

For occupational doses at the proposed Ross Project, the planned ISR facility design and operations are consistent with those analyzed in the GEIS. To mitigate radiological exposure to workers, the applicant will (i) install ventilation designed to limit worker exposure to radon; (ii) install gamma exposure rate monitors, air particulate monitors, and radon daughter product monitors to verify that expected radiation levels are met; and (iii) conduct work area radiation and contamination surveys to help prevent and limit the spread of contamination (Strata, 2011a). The applicant's airborne radiation monitoring program is further described in SEIS Section 6.

For estimated maximum dose to members of the public, GEIS Section 4.4.11.1.2 noted that radon gas is emitted from ISR wellfields and processing facilities during operations and is the only radiological airborne effluent during normal operations for facilities using vacuum dryer technology (NRC, 2009). The Applicant plans to dry yellowcake using a rotary vacuum dryer (Strata, 2011a). Therefore, during normal operations, emissions other than radon are not expected.

The Applicant evaluated the potential consequences of radiological emissions at the proposed Ross Project (Strata, 2011a). Sources of radon emanation the Applicant identified and modeled consisted of point sources (i.e., those operations that have their exhaust confined in a stack, duct, pipe, etc., prior to atmospheric release, such as process tank vents) and area sources (i.e., ore pads and wellfields). The Applicant described its implementation of the computer code MILDOS that was used to model radiological impacts on human and environmental receptors (e.g., air and soil) using site-specific data that included Rn-222 release estimates, meteorological and population data, and other parameters. The estimated radiological impacts from routine site activities were compared to applicable public dose limits in 10 CFR Part 20 {1 mSv/yr [100 mrem/yr]}, as well as to baseline radiological conditions (see SEIS Section 3).

The NRC review of the Applicant's radiological impact modeling independently verified that appropriate exposure pathways were modeled and reasonable input parameters were used. The Applicant also listed the origin of the input parameters and provided justification for their use. The Applicant described the source terms, and the NRC staff review concluded that the source terms represented operations at full capacity and consisted of ISR operations at the wellfields and releases from the CPP and deep disposal wells. The Applicant calculated the TEDE across the projected area on a grid system centered about the CPP and extending beyond the site boundary for a total of 287 locations, 14 members of the public including children that could be living at the four nearest residences and the Oshoto Field Office, 5 ranchers, 2 oil-field workers, and 2 vendors/couriers working both within and outside of the project area.

Results of the Applicant's modeling indicate that the maximum TEDE of 0.016 mSv/yr [1.6 mrem/yr] is located near the Ross Project boundary in the vicinity of the CPP area. The Applicant's calculations also demonstrate that inhalation accounted for 98 percent of the TEDE at this location (Strata. 2011a). Thus, the 10 CFR Part 20 public dose limit is not expected to be exceeded at any property boundary. The annual background dose to the population within 80 km of the Ross Project is estimated at 10,500 person-rem based on a background radiation dose of 2.57 mSv/yr for Wyoming. For comparison, the TEDE from the Ross Project to the population based on the Applicant's modeling is estimated to be 0.361 person-rem. This TEDE represents 1.6 percent of the 10 CFR Part 20 public dose limit of 1 mSv/yr [100 mrem/yr].

Because Rn-222 is the only radionuclide emitted during normal operations, the public dose requirements in 40 CFR Part 190 and the 0.1 mSv/yr [10 mrem/yr] constraint rule in 10 CFR Part 20.1101 do not apply. The Applicant calculated that radon emissions from the wellfields accounted for 75 percent of the total emissions. In its calculations, the Applicant assumed that 100 percent of the radon in the liquids was released to the atmosphere. The estimated radon release from the facility is listed in Table 7.3-4 of the application (Strata, 2011a). The dose to the public is below the 10 CFR Part 20 public dose limit, thus, radiological dose impacts to the public from normal operations will be SMALL.

In summary, potential radiation doses to occupationally exposed workers and members of the public during normal operations would be SMALL. Calculated radiation doses from the releases of radioactive materials to the environment are small fractions of the limits in 10 CFR Part 20 that have been established for the protection of public health and safety. In addition, the applicant is required to implement an NRC-approved radiation protection program (RPP) to protect occupational workers and ensure that radiological doses are as low as reasonably achievable (ALARA). The applicant's RPP includes commitments for implementing management controls, engineering controls, radiation safety training, radon monitoring and sampling, and audit programs (Strata, 2011a).

Accident Conditions

The GEIS identified, discussed, and assessed the consequences for bounding abnormal and accident conditions that might occur with an ISR operation. The GEIS information was based on previous radiological hazard assessments (Mackin, et al., 2001) that considered the various stages of an ISR facility. The GEIS considered three separate accidents, which represent events resulting in higher levels of radioactivity being released: thickener failure and spill, pregnant lixiviant and loaded resin spills (radon release), and yellowcake dryer accident release. The GEIS concluded that potential impacts to workers could be MODERATE based on the estimated consequences of an unmitigated dryer release, but doses to the general public would be SMALL.

An overview of these three accident scenarios, as evaluated in the GEIS along with a specific application to the Ross Project, is presented in the following paragraphs.

Thickener Failure and Spill

Thickeners are used to concentrate yellowcake slurry before it is transferred to a dryer or packaged for offsite shipment. Radionuclides could be inadvertently released to the atmosphere through thickener failure or spill. This accident scenario, as evaluated in the GEIS, assumed a tank or pipe leak that releases 20 percent of the thickener inside and outside of the processing building. The analyses included a variety of wind speeds, stability classes, release durations, and receptor distances. A minimum receptor distance of 500 m [1,640 ft] was selected because it was found to be the shortest distance between a processing facility and an urban development for currently operating ISR facilities. Offsite, unrestricted doses from such a spill could result in a dose of 0.25 mSv [25 mrem], or 25 percent of the annual public dose limit of 1 mSv [100 mrem] per year with negligible external doses based on sufficient distance between facility and receptor (NRC, 2009). The nearest two residences to the Ross Project facility are located at a distance of 800 m [2,500 ft] and 1,700 m [5,600 ft], which are further than the minimum distance analyzed in the GEIS. Therefore, the potential public dose from a thickener spill at the Ross Project would be less than the dose estimated in the GEIS.

As stated in the GEIS, doses to unprotected workers inside the facility have the potential to exceed the annual dose limit of 0.05 Sv [5 rem] if timely corrective measures are not taken to remediate the spill. Typical protection measures such as monitoring, respiratory protection, and radioactive material control, which would be a part of the applicant's radiation protection program, would reduce worker exposures and resulting doses to a small fraction of those evaluated (NRC, 2009). The Applicant has proposed a radiation protection program and a spill response program that would include similar commitments to those described in the GEIS, such as requiring the use of personal protective equipment (PPE) (Strata, 2011a). Therefore, the potential dose to workers at the Ross Project from a thickener spill is expected to be consistent with the dose estimate provided in the GEIS but this dose would be reduced significantly, as described in the GEIS, by the Applicant's implementation of radiation protection and spill response programs.

Pregnant Lixiviant and Loaded Resin Spills

Process equipment (e.g., ion-exchange columns) at the Ross Project would be located on curbed concrete pads to prevent any liquids from spills or leaks from exiting the building and contaminating the outside environment of the facility. In the event of a process tank failure, released fluids would be captured in concrete berms in the process building, which would be designed to contain a volume of 110 percent of the largest tank in the building (Strata, 2011b). Collected fluids would be pumped via a sump to other process vessels, a lined surface impoundment, or a deep disposal well and the contaminated area would be washed down. Additionally, personnel would follow spill response procedures, which would require the use of PPE (Strata, 2011a). Therefore, except for wellfield leaks, the NRC staff does not consider an accidental liquid release with liquid pathways of exposure to be realistic. The primary radiation source for liquid releases within the Ross Project facility would be the resulting airborne radon-222 released from a liquid or resin tank spill.

In the case of a wellfield leak at the Ross Project, pregnant lixiviant could be released from the pipes containing the fluid onto the soil below. The Applicant would be able to identify such a leak by monitoring the pipelines to detect changes in pressure or flow. If a significant change in pressure or flow is detected, an alarm would sound at the CPP, which would prompt the Applicant's personnel to investigate the cause and identify any leaks. If the pressure or flow change is outside of acceptable operating parameters, the pumping system would automatically shut down. Additionally, wellfield operators would visually inspect all piping and equipment within the module buildings, wellheads, and valve vaults at least weekly (Strata, 2011a). Potentially contaminated soil will be sampled and contaminated soil would be removed and disposed of in accordance with NRC and State requirements. In the event of a spill that meets NRC criteria for reporting, the Applicant will notify the NRC within 24 hours and submit a report within 30 days that describes the conditions leading to the spill, the corrective actions taken, and the results achieved.

The GEIS assumed a radon accident release scenario in which a pipe or valve of the ion-exchange system, containing pregnant lixiviant, develops a leak and releases (almost instantaneously) all the radon-222 at a high activity level (2.96 x 10^7 Bq/m^3 [8 x 10^5 pCi/L]). For a 30-minute exposure, the dose to a worker located inside the building performing light activities without respiratory protection was estimated as 10 mSv [1,300 mrem], which is below the 10 CFR Part 20 occupational dose limits (NRC, 2009). The Ross Project would include a piping system containing pregnant lixiviant consistent with the system evaluated in the GEIS and, therefore, the potential dose estimated in the GEIS is consistent with the dose expected during this type of accident scenario at the Ross Project. Ventilation systems and alarms at the Ross Project that would alert workers to immediately evacuate the building would further reduce the potential exposure and resulting dose to workers. Considering that atmospheric transport offsite would reduce the airborne levels by several orders of magnitude, any dose to a member of the public would be less than the 1 mSv [100 mrem] public dose limit of 10 CFR Part 20.

Yellowcake Dryer Accident Release

In GEIS Section 4.4.11.2.2, the consequences of an explosion involving a multiple-hearth yellowcake dryer at an ISR facility were evaluated. The analysis assumes that about 4,409 kg [9,500 lb] of uranium yellowcake is released within the building housing the dryer and that, due to the nature of the material, most of the yellowcake would rapidly fall out of airborne suspension. Therefore, only 1 kg [2.2 lb] of the yellowcake is assumed to be subsequently released as an airborne effluent to the outside atmosphere as a 100 percent respirable powder. The calculated maximum dose to workers in this scenario would be 0.088 Sv [8.8 rem], which exceeds the annual occupational dose limit of 0.05 Sv [5 rem] established in 10 CFR Part 20. The atmospheric dispersion of the fraction of the yellowcake that is assumed to be released as an airborne effluent would significantly reduce the exposure to members of the public to about 6.5 x 10-4 Sv [65 mrem], which is less than the 10 CFR Part 20 public dose limit of 1 mSv [100 mrem] (NRC, 1980).

The Applicant proposes to use a vacuum dryer for both yellowcake and vanadium, which is the current industry standard for ISR facilities. In a vacuum dryer, the heater combustion source is separated from the dryer itself. This configuration mostly eliminates the possibility of an explosion, which is the initiating event for the accident scenario considered in the GEIS. Therefore, the vacuum dryer accident release that could occur at the Ross Project is expected to have less significant consequences than the multiple-hearth yellowcake dryer accident release scenario considered in the GEIS. The Applicant analyzed the potential for a release of yellowcake from a vacuum dryer into the dryer room due to a seal rupture. Operating procedures proposed by the Applicant such as conducting regular inspections of the seals and monitoring for pressure changes and other indicators of problems with the seal during dryer operations would reduce the likelihood of an unnoticed seal rupture. However, in the event of a yellowcake release due to a seal rupture, dose to workers would be minimized because they would be required to wear respiratory protection when the dryer is in operation and would immediately evacuate the area. Public exposure would be significantly reduced, as described in the GEIS, due to atmospheric dispersion of any fraction of the yellowcake that is released from the dryer building.

Accident Analysis Conclusions

The NRC staff reviewed and evaluated site-specific and project-specific information related to potential accidents and determined that the types of accidents analyzed in the GEIS and their potential consequences bound those that could occur for the proposed Ross Project. There would be no significant radiological impacts from potential accidents to the public or occupationally exposed workers beyond those described in the GEIS. Based on this finding, the potential doses may result in a MODERATE impact to occupational health and safety, in the case of an unmitigated accident, and a SMALL impact to public health and safety. Occupational health and safety impacts from accidents would be reduced by the Applicant implementing protection measures such as routine monitoring, spill response and cleanup procedures, and respiratory protection. Therefore, the overall radiological impacts to public and occupational health and safety from accidents during operations would be SMALL.

Nonradiological

Normal Conditions

GEIS Section 4.4.11.2.4 identified the various chemicals, hazardous and nonhazardous, that are typically used at ISR facilities. The GEIS also identifies the typical quantities of these chemicals that are used. The following hazardous chemicals would be used in the largest quantities at the CPP during the Ross Project's operation:

- Anhydrous ammonia
- Sodium hydroxide
- Sulfuric acid and/or hydrochloric acid
- Oxygen
- Hydrogen peroxide
- Carbon dioxide
- Sodium carbonate
- Sodium chloride
- Ammonium sulfate

Each of these chemicals would be purchased in bulk, would be transported to the Project area by motorized vehicles, and would be stored within the controlled area of the Ross Project (i.e., in the fenced facility itself). Typical onsite quantities for some of these chemicals exceed the regulated, minimum reporting quantities and trigger an increased level of regulatory oversight regarding possession (type and quantities), storage, use, and disposal practices. The use of hazardous chemicals at ISR facilities is controlled under several regulations that are designed to provide adequate protection to workers and the public. The primary regulations applicable to use and storage include the following:

- **40 CFR Part 68:** ***Chemical Accident Prevention Provisions***. This regulation lists regulated toxic substances and threshold quantities for accidental-release prevention.
- **29 CFR Part 1910.119:** ***Occupational Safety and Health Administration Standards/Process Safety Management of Highly Hazardous Chemicals***. This regulation lists highly hazardous chemicals as well as toxic and reactive substances (i.e., chemicals that can potentially cause a catastrophic event at or above the threshold quantity).
- **29 CFR Part 1910.120:** ***Hazardous Waste Operations and Emergency Response****.* This regulation instructs employers to develop and implement a written health and safety program for their employees involved in hazardous-waste operations. The program should

be designed to identify, evaluate, and control health and safety hazards and provide for emergency response during hazardous-waste operations.

- **40 CFR Part 355:** ***Emergency Planning and Notification***. This regulation lists extremely hazardous substances and their threshold planning quantities so that emergency response plans can be developed and implemented. There are approximately 360 extremely hazardous substances listed. Over a third of these are defined by the *Comprehensive Environmental Response, Compensation, and Liability Act* (CERCLA), the "Superfund" law. The regulations associated with this statute also list so-called "reportable quantity" values for these substances.
- **40 CFR Part 302.4:** ***Designation, Reportable Quantities, and Notification/Designation of Hazardous Substances***. This regulation identifies the reportable quantities for the CERCLA hazardous substances on the promulgated list. There are approximately 800 of these substances, and they are compiled from the 1) CWA, Sections 311 and 307(a); 2) CAA, Section 112; 3) *Resource Conservation and Recovery Act* [RCRA], Section 3001; and 4) *Toxic Substance Control Act*, Section 7.

The Applicant's compliance with applicable regulations would reduce the likelihood of continuing or significant releases, which may result in injury or illness to an exposed worker. The risk of offsite impacts to the public due to a chemical spill is not significant because chemicals would be stored and used in or near the facility and wellfields. Therefore, impacts to the public would be SMALL.

To promote occupational health and safety, the Applicant would issue a formal Safety Policy Statement to define its overall health- and safety-protection policy and the requirements that must be met by all employees and contractors at all times while at the Ross Project (Strata, 2012a). In addition, the Applicant proposes the development of several plans, SOPs, and other management tools to further decrease and mitigate occupational health and safety impacts (Strata, 2011a). All workers and contractors would receive required health and safety training. This training would include indoctrination to plans such as the Project's HASP, as well as all pertinent SOPs and BMPs. The Ross Project would operate under a comprehensive Project HASP, which would include specific industrial-hygiene SOPs and other health and safety plans. These SOPs would govern a worker entering a confined space, trenching and excavation of utility and pipeline corridors, referring to appropriate Material Safety Data Sheets (MSDSs), decanting a hazardous chemical, and donning appropriate levels of PPE. Other health and safety plans could include a respiratory protection plan, a hearing conservation plan, and a health and safety training plan. These latter plans would be developed and instituted by the Applicant only when it is not practical to use process or other engineering controls [Strata, 2012a]). The Applicant's HASP would also include specific training requirements and hazard identification and mitigation policies and procedures. The HASP would define the protocols, methods, and procedures the Applicant would use to ensure compliance with the OSHA requirements found at 29 CFR Part 1910.

The types and quantities of chemicals (hazardous and nonhazardous) identified for use at the proposed Ross Project are consistent with those evaluated in the GEIS. Additionally, the Applicant proposes to implement the occupational health and safety protection plans evaluated for typical ISR facilities in the GEIS and to comply with the requirements of regulations governing the use and storage of chemicals. Therefore, the NRC staff concludes that the nonradiological impacts to public and occupational health and safety during normal operations of the Proposed Action would be SMALL.

Accident Conditions

Potential nonradiological accidents are consistent with the typical accidents at other industrial facilities, including high consequence chemical release events. In GEIS Section 4.4.11.2.2, the likelihood of such a release is determined to be low based on historical operating experience at ISR facilities, primarily due to operators following commonly applied chemical safety and handling protocols. Past history at current and former ISR facilities demonstrates that these facilities can be designed and operated with measures that adequately reduce the risks to worker and public health and safety. The GEIS concluded that the nonradiological impacts due to accidents at an ISR facility would be SMALL offsite and potentially MODERATE for workers involved in accident response and cleanup.

If a large quantity of one or more of the chemicals that would be present in significant quantities at the Ross Project were to be released during the Ross Project's operation, the nonradiological impacts to public health and safety would depend on the proximity of potentially impacted populations. Potential receptors are sparse in the area around the Ross Project (the nearest residents to the Ross Project are identified in Figure 3.1 in SEIS Section 3.2). In addition, the Ross Project area is large and affords distance that would allow released hazardous chemicals to be either deposited or dispersed before reaching the Project boundaries, thereby diminishing individual impacts. Workers involved in a response and cleanup of an accident could experience MODERATE impacts, but training requirements and the establishment of and adherence to applicable procedures would reduce the impact to SMALL. Thus, consistent with the GEIS, impacts to public and occupational health and safety due to an onsite accident during Ross Project operations would be SMALL.

4.13.1.3 Ross Project Aquifer Restoration

GEIS Section 4.4.11 indicated that the activities that would take place during aquifer restoration are similar to ISR facility operation (i.e., wellfield operation, uranium extraction, waste-water treatment, and waste disposal), except that each would begin to diminish as less and less uranium is recovered from the production aquifer. The gradual cessation of many of these processes as the Ross Project, such as loaded-IX-resin elution, yellowcake drying and packaging, vanadium recovery and packaging, further limits the relative magnitude of potential public and occupational health and safety hazards. There would be fewer opportunities for accidents with the decreasing number of operations and the decreasing workforce as well as fewer chemicals used onsite and smaller volumes of chemicals stored onsite. The same mitigation measures and management controls, such as the RPP and the Project's HASP, as discussed earlier for the Ross Project's construction and operation would be observed during its aquifer-restoration phase. Thus, the nonradiological and radiological impacts to public and occupational health and safety during aquifer restoration would be SMALL.

4.13.1.4 Ross Project Decommissioning

The GEIS found in Section 4.4.11 (NRC, 2009) that the radiological impacts to the public and occupational health and safety from the decommissioning of an ISR project would be SMALL. Consistent with the description in the GEIS, the magnitudes of potential impacts from the decommissioning of the Ross Project facility and its wellfields would be less significant than impacts during operations because hazards would be reduced and eliminated; and soils, structures, and equipment would be decontaminated.

In addition to the mitigation measures described in SEIS Section 4.13.1.1, the NRC would require that the Applicant submit a decommissioning plan for the Ross Project for its review and approval. Protection of workers and the public is ensured through NRC approval of the decommissioning plan and verification that doses from exposures during decommissioning would comply with 10 CFR Part 20 limits. Following decommissioning, the Ross Project site could be released for unrestricted use in conformance with the conditions of the NRC license and the dose criteria for site release in 10 CFR Part 40, Appendix A. The criteria in 10 CFR Part 40, Appendix A limit the dose from radiological contamination that may exist at the site after decommissioning is complete to levels that are sufficiently low to protect public health and safety. Therefore, the impacts to public and occupational health and safety from the decommissioning of the Ross Project would be SMALL.

4.13.2 Alternative 2: No Action

Under the No-Action Alternative, the Ross Project would not be licensed and the land would continue to be available for other uses. However, until the NRC has made its decision regarding the licensing of the Project, the Applicant could continue with some of preconstruction activities (e.g., monitoring well installation). In addition, if the NRC license is not issued, there would need to be some additional work to properly abandon the wells that would have been installed by the Applicant. However, the public and occupational impacts to health and safety of this No-Action Alternative would be less than those impacts associated with the construction of the Proposed Action (i.e., Alternative 1). Thus, the public and occupational impacts of the No-Action Alternative would be SMALL.

4.13.3 Alternative 3: North Ross Project

Under Alternative 3, the North Ross Project would generally be the same as the Proposed Action, except that the facility (i.e., the CPP, associated buildings, and auxiliary structures as well as the surface impoundments) would be located to the north of where it would be located in the Proposed Action and the construction of a CBW would not be necessary, as described in SEIS Section 2.1.3.

Under Alternative 3, the length of the wellfield pipelines may be increased and, thus, there would be more pipeline subject to failure. However, the Applicant would implement the same procedures described under the Proposed Action to reduce the risk and severity of pipeline failures (e.g. monitoring the pipelines to detect changes in pressure or flow, allowing for automatic shut down of the pumping system, visually inspecting piping at least weekly, and removing contaminated soil).

Alternative 3 would be located, constructed, and operated farther away from the primary roads to the Ross Project area, which would require the construction of additional road extensions. This road construction would generate additional fugitive dust. However, the nearest residential receptors would be farther away from the CPP under the North Ross Project than they would be from the location of the CPP under the Proposed Action; thus, they would be less affected overall by fugitive dust and/or the impacts of accidents. Construction activities and chemical use would be similar to the Proposed Action because the construction footprint of the facility would be consistent with the Proposed Action. Construction activities associated with constructing and decommissioning the CBW with the Proposed Action and the associated incremental contribution to public and occupational health and safety would not be present under Alternative 3. All other potential public and occupational health impacts would be the same as described for the Ross Project in this SEIS Section 4.13.1. Consequently, as with the Proposed Action, workers involved in a response and cleanup of an accident could experience MODERATE impacts, but training requirements and the establishment of and adherence to applicable procedures would reduce the impact to SMALL. Thus, the impacts to public and occupational health and safety of Alternative 3 would be SMALL.

4.14 Waste Management

The Proposed Action could have potential waste-management impacts during all phases of its lifecycle. Waste volumes, disposal practices, and associated mitigation measures for the four phases of the Proposed Action are evaluated and compared to the impacts identified in the GEIS (NRC, 2009). The waste management practices, waste types, and estimated waste volumes that the Applicant proposes are generally consistent with the typical ISR facility described in the GEIS. The impacts of the Applicant's management of liquid and solid waste streams for each phase of the Proposed Action as well as the two Alternatives are evaluated in this section. All of the three Alternatives are described in SEIS Section 2.1; impacts from the transportation of solid wastes offsite for disposal are evaluated in SEIS Section 4.3.1; impacts to the geology, soils, and water resources as a result of spills, leaks, and other accidental releases of liquid wastes as well as onsite disposal of liquid wastes are assessed in SEIS Sections 4.3.1 and 4.4.1, respectively.

4.14.1 Alternative 1: Proposed Action

Alternative 1, the Proposed Action, consists of four phases: construction, operation, aquifer restoration, and decommissioning of a uranium-recovery facility and wellfields.

The volumes of each type of waste the Applicant expects to be generated by the Ross Project and the Applicant's proposed management approach and disposal activities are fully described in SEIS Section 2.1.1 and are shown in Table 4.9. As described, the specific permits that the Applicant would need to obtain for its UIC Class I deep-injection wells would mitigate many of the impacts of liquid-waste disposal at the Project. The pre-operational agreements with solid-waste and radioactive-waste disposal facilities that are required to be in place prior to the NRC's issuing a license to the Applicant would mitigate impacts from solid-waste management (NRC, 2009). As part of these agreements, the Applicant would need to ensure that sufficient capacity for solid byproduct wastes (liquid byproduct wastes would be disposed of onsite in the deep-injection Class I UIC wells) would be available throughout the lifecycle of the Ross Project (NRC, 2009). NRC license conditions and inspections would ensure that proper practices are used by the Applicant to comply with safety requirements to protect workers and the public during waste management (NRC, 2009). The Applicant would implement waste-minimization and volume-reduction BMPs, as possible, to further mitigate the impacts of waste management (Strata, 2011a).

Each of the disposal facilities noted in Table 4.9 has indicated to the Applicant that it has sufficient disposal capacity to accept the volumes of wastes shown in Table 4.9 (see Table ER RAI Waste-1-1 in Strata, 2012a).

Table 4.9
Ross Project Waste Streams

Waste Stream	Source	Disposal Method	Estimated Typical Quality
NRC-Regulated Wastes			
Excess Permeate	Uranium Production Aquifer Restoration RO Circuits	Reinjection into Wellfield CPP Make-Up Water Deep-Well Injection	C: 0 m^3/min [0 gal/min] O: 0.2 m^3/min [57 gall/min] R: 0 m^3/min [0 gal/min] D: 0 m^3/min [0 gal/min]
Brine and Other Liquid Byproduct Wastes	Uranium Production Aquifer Restoration RO Circuits Spent Eluate Process Drains Contaminated Reagents Filter Backwash Wash-Down Water Decontamination Showers	Deep-Well Injection Evaporation from Surface Impoundments	C: 0 m^3/min [0 gal/min] O: 0.2 m^3/min [62 gal/min] R: 0.9 m^3/min [227 gal/min] D: 0.04 m^3/min [<10 gal/min]
Solid Byproduct Wastes	Filtrate and Spent Filters Scale and Sludges from Equipment Maintenance Contaminated Soils Damaged IX Resins Contaminated Solids from Wells Contaminated PPE Contaminated Materials and Equipment	Shipment to NRC- or Agreement State-Licensed Disposal Facility	C: 0 m^3 [0 yd^3] O: 76 m^3/yr [100 yd^3/yr] R: 76 m^3/yr [100 yd^3/yr] D: 3,058 m^3 [4,000 yd^3]
Non-NRC-Regulated Wastes			
TENORM	Drilling Fluids and Muds	Mud Pits	C: Per Well = Drilling Fluids 23 m^3 [6,000 gal] Drilling Muds 0.1 m^3 [15 yd^3] O: 0 m^3 [0 gal] R: 0 m^3 [0 gal] D: 0 m^3 [0 gal]
Industrial or Municipal Solid Waste	General Office Trash	Shipment to Municipal Landfill	C: 11 m^3/wk [15 yd^3/wk] O: 11 m^3/wk [15 yd^3/wk] R: 11 m^3/wk [15 yd^3/wk] D: 11 m^3/wk [15 yd^3/wk]
Recyclable Solid Waste	Plastic, Glass, Paper, Aluminum, and Cardboard	Shipment to Municipal Recycling Facility Recyclable Waste-Collection Facility	C: 4 m^3/wk [5 yd^3/wk] O: 4 m^3/wk [5 yd^3/wk] R: 4 m^3/wk [5 yd^3/wk] D: 4 m^3/wk [5 yd^3/wk]

Table 4.9
Ross Project Waste Streams
(*Continued*)

Waste Stream	Source	Disposal Method	Estimated Typical Quality
Construction and Demolition Debris	Construction Debris Decontaminated Materials and Equipment	Shipment to Demolition-Debris Landfill	C: 4 m^3/wk [5 yd^3/wk] O: 4 m^3/wk [5 yd^3/wk] R: 4 m^3/wk [5 yd^3/wk] D: 1,529 m^3 [2,000 15 yd^3]
Petroleum-Contaminated Soil	Equipment Spills and Leaks	Shipment to WDEQ/SHWD-Permitted Disposal Facility	C: < 0.8 m^3/mo [< 1 yd^3/wk] O: < 0.8 m^3/mo [< 1 yd^3/wk] R: < 0.8 m^3/mo [< 1 yd^3/wk] D: < 0.8 m^3/mo [< 1 yd^3/wk]
Hazardous Waste	Used Batteries Expired Laboratory Reagents Fluorescent Bulbs Solvents, Cleaners, and Degreasers	Shipment to WDEQ/SHWD-Permitted Recycling or Disposal Facility	C, O, R, D: < 100 kg/mo [< 220 lb/mo]
Used Oil	Vehicle Maintenance	Shipment to Used-Oil Recycling Facility	C: 0.02 m^3/mo [5 gal/mo] O: 0.02 m^3/mo [5 gal/mo] R: 0.02 m^3/mo [5 gal/mo] D: 0.02 m^3/mo [5 gal/mo]
Used Oil Filters and Oily Rags	Vehicle and Equipment Maintenance	Shipment to Used-Oil Recycling Facility	C: < 9 m^3 [< 20 lb/mo] O: < 9 m^3 [< 20 lb/mo] R: < 9 m^3 [< 20 lb/mo] D: < 9 m^3 [< 20 lb/mo]
Domestic Sewage	Restrooms	Onsite Waste-Water Disposal or Treatment System Holding Tanks/Portable Toilets during Construction and Decommissioning	C: 9.8 m^3/d [2,600 gal/d] O: 3 m^3/d [800 gal/d] R: 1.1 m^3/d [300 gal/d] D: 4.5 m^3/d [1,200 gal/d]

Source: Strata, 2012a.

Notes:
C = Construction
O = Operation
R = Aquifer Restoration
D = Decommissioning

4.14.1.1 Ross Project Construction

As described in GEIS Section 4.4.12, construction activities would be expected to generate low volumes of wastes. No radioactive wastes that are regulated by the NRC would be generated during the Proposed Action's construction phase. The GEIS found that the waste management impacts from the construction of an ISR facility would be SMALL due to the limited volumes of wastes (NRC, 2009).

Liquid Waste

Non-byproduct liquid waste would be generated during construction of the Ross Project from the Applicant's drilling and development of injection, recovery, and monitoring wells. Construction of the Class I deep-injection wells would produce drilling fluids and muds. The Applicant estimates that a volume of 22,000 L [6,000 gal] of water and 12 m^3 [15 yd^3] of drilling muds would be produced per well (Strata, 2012a). These fluids would be stored onsite in mud pits which would be constructed adjacent to the respective drilling pad(s) and evaporated. The GEIS found that the liquid waste management impacts from the construction of an ISR facility would be SMALL due to the limited volumes of wastes (NRC, 2009).

Construction releases from the mud pits would be mitigated by the implementation of sediment-control BMPs (Strata, 2011a). The dried pits would ultimately be backfilled, graded, covered with topsoil, and reseeded to achieve the reclamation standards required by WDEQ/LQD (Strata, 2011a). The Applicant would attempt to complete reclamation of the mud pits within one construction season to minimize wind and water erosion. The reclaimed mud pits would be included in the radiation surveys that would be accomplished during the Proposed Action's decommissioning so that no potential long-term impacts from radioactivity are present (Strata, 2011a).

The Applicant estimates that 19 L/mo [5 gal/mo] of used oil would be generated and shipped to a local commercial recycler (Strata, 2012a). The Applicant also estimates that 9,842 L/d [2,600 gal/d] of domestic sewage would be generated during construction; this waste would be managed in an onsite domestic waste-water system designed according to WDEQ/WQD standards (Strata, 2011a).

The potential impacts of the management of liquid wastes during construction, therefore, would be SMALL.

Solid Waste

Solid wastes generated during the construction of the Proposed Action would be of limited quantity and volume. The estimated volume of each type of waste and the respective disposal practices that would be used by the Applicant to manage the wastes are described in SEIS Section 2.1.1 and are summarized as follows:

- Less than 9 kg/mo [20 lb/mo] of used oil filters and oily rags would be produced and shipped to a local commercial recycler.
- 19 m^3/wk [25 yd^3/wk] of solid waste not regulated by the NRC nor the EPA would be generated and disposed or recycled at an offsite local landfill.
- Less than 1 m^3/wk [1 yd^3/wk] of petroleum-contaminated soil would be transported by a waste-disposal contractor to a permitted facility in northeast Wyoming, such as the Campbell County Landfill.
- Less than 100 kg/mo [220 lb/mo] of hazardous waste would be securely and appropriately accumulated at the Ross Project and transported by a hazardous-waste contractor to an

appropriately permitted, commercial treatment, storage and disposal (TSD) facility outside of Wyoming (Strata, 2012a).

The Applicant proposes to minimize the volume of used oil and hazardous waste by servicing its vehicles and equipment offsite and by limiting its chemical-reagent orders to quantities that can be consumed within the regents' shelf lives (Strata, 2011a).

Waste volumes are similar to those described in Section 4.4.12 of the GEIS. Thus, the potential impacts of the management of solid wastes during the construction of the Proposed Action would be SMALL.

4.14.1.2 Ross Project Operation

As described in GEIS Section 4.4.12, waste-management impacts during the operation of an ISR facility would be SMALL, based upon the required preoperational disposal agreement(s) for solid radioactive wastes in addition to regulatory controls such as the applicable permit and license conditions with which an Applicant must comply as well as the inspections the NRC and other regulatory agencies would perform (NRC, 2009). At the Ross Project, the UIC Permit for the Class I injection wells that has already been obtained by Strata for deep-well injection of liquid byproduct (i.e., radioactive) waste specifies operating conditions and reporting requirements with which the Applicant must comply (WDEQ/WQD, 2011). Design specifications related to radioactive waste that would need to be approved by the NRC include waste treatment and volume reduction techniques, surface-impoundment leak detection systems, and other routine monitoring activities that would further minimize the potential for impacts to the environment (NRC, 2009).

Liquid Waste

As described in SEIS Section 2.1.1, liquid byproduct waste generated during ISR operations would include process bleed (an average of 1.5 percent of injection volume) and other process waste waters. The process bleed would be treated by a two-stage RO circuit during the Proposed Action, producing a minimized volume of brine and permeate. Permeate from the RO process would be re-used as plant make-up water or lixiviant. Excess permeate requiring disposal would be only generated during the first two and one-half years of ISR operations before aquifer restoration begins (Strata, 2011a). The Applicant proposes that excess permeate, up to 190 L/min [50 gal/min] would be discharged to the surface impoundments. The double-liner, leak-detection system the Applicant proposes for its surface impoundments, in addition to the monitoring and reserve-capacity requirements mandated by NRC regulations and NRC license conditions, would allow detection of any surface-impoundment spills or leaks before any significant release of material occurs (NRC, 2009). These requirements were also anticipated by the GEIS, when it concluded that similar waste-management techniques would result in SMALL impacts. Thus, the potential impacts of the Proposed Action's use of surface impoundments for the management of liquid byproduct waste would be SMALL.

The Applicant estimates that approximately 240 L/min [62 gal/min] of brine and other process waters would be disposed of into the UIC-permitted Class I deep-injection wells that the Applicant has already obtained from the WDEQ/WQD (WDEQ/WQD, 2011). The lined surface impoundments and a storage tank with secondary containment would be used to manage the brine before its disposal in the deep-injection wells (Strata, 2012b). The use of the surface impoundments for waste management and the disposal by deep-well injection that the Applicant proposes are consistent with the waste-management practices described in the GEIS.

The Applicant expects that ground water generated during the construction and development of recovery and injection wells would be disposed of in mud pits similarly to the disposal of drilling fluids generated during the construction phase. However, drilling fluids generated during development of wells completed in an aquifer affected by uranium-recovery operations would be disposed of in the lined retention ponds or via the deep disposal wells (Strata, 2012b).

The volume of used oil that would be produced during the Proposed Action's operation and its management would be the same as during its construction (Strata, 2012a). The volume of domestic sewage, which would be managed in an onsite system, would be approximately 3,000 L/d [800 gal/d] (Strata, 2012a).

The potential impacts of the management of liquid wastes during operation would therefore be SMALL.

Solid Waste

As described in SEIS Section 2.1.1, the Applicant estimates that approximately 80 m^3/yr [100 yd^3/yr] of solid byproduct (i.e., radioactive) waste would be generated during the operation phase of the Proposed Action (Strata, 2012a). The Applicant proposes to minimize the quantity of byproduct solid waste by selecting high-efficiency filter media for uranium-recovery and aquifer-restoration circuits (Strata, 2011a). Getting more use out of filter media would minimize the quantity used as well as the waste generated during operation. This byproduct waste would be accumulated inside 208-L [55-gal], lined drums and stored in a restricted area of the CPP (Strata, 2011a). Full drums would later be sealed and then moved into a 15-m^3 [20-yd^3] roll-off container. Roll-off containers would be stored in a restricted area outside of the CPP where access is secured and restricted. Sealed roll-off containers would be transported to a radioactive-waste disposal facility licensed by the NRC or an Agreement State. This disposal would only be allowed by the NRC after preoperational agreements between the Applicant and the licensed facility(ies) have been executed. The Applicant has identified four facilities currently licensed to receive such byproduct waste and that can ensure adequate capacity for the solid byproduct waste generated by the Ross Project (Strata, 2012a).

Solid non-byproduct waste and hazardous-waste volumes generated during the Proposed Action's operation would be similar to or less than that generated during its construction (Strata, 2011a). Therefore, the potential impacts of the management of all solid wastes during Ross Project operation would be SMALL.

4.14.1.3 Ross Project Aquifer Restoration

In GEIS Section 4.4.12.3, the impacts associated with waste management during an ISR facility's aquifer-restoration phase were evaluated. These were determined to be generally the same as those during its operation. Thus, the GEIS found that waste-management impacts would be SMALL.

Liquid Waste

Liquid byproduct (radioactive) wastes generated during the Proposed Action's aquifer restoration would amount to approximately 740 L/min [190 gal/min] of brine. The Applicant proposes to minimize the volume of liquid byproduct waste that would be generated while the Ross Project is in the aquifer-restoration phase by its limiting the ground-water sweep to the perimeter of a wellfield module, rather than throughout the entire module. As during operation, the two-stage RO circuit would reduce the volume of brine requiring disposal. Evaporation of stored brine from the surface impoundments would further reduce the volume of brine needing disposal by an estimated 36 L/min [9.3 gal/min]. All permeate from the RO process would be used for process water and aquifer restoration.

The volume of used oil that would be produced during the Proposed Action's aquifer-restoration phase would be the same as that produced during its construction and operation (Strata, 2012a). The volume of domestic sewage managed with the Ross Project's onsite treatment system would decrease to approximately 1,100 L/d [300 gal/d] (Strata, 2012a) due to the smaller number of workers at the Ross Project during aquifer restoration. Thus, the potential impacts of the management of all types of liquid wastes during aquifer restoration at the Proposed Action would be SMALL.

Solid Waste

The management of solid wastes, including byproduct, radioactive and hazardous wastes, generated during the aquifer-restoration phase of the Proposed Action would be similar to its construction and operation phases (Strata, 2011a). The volume of office and municipal solid wastes would decrease due to the smaller workforce during aquifer restoration (i.e., 200 and 60 vs. 20 workers), while the volume of byproduct and other radioactive wastes would also diminish, producing less and less waste contaminated by byproduct materials, as the aquifer is restored. Thus, the potential impacts of the management of solid wastes during aquifer restoration would be SMALL.

4.14.1.4 Ross Project Decommissioning

As described in GEIS Section 4.4.12, the impacts associated with liquid-waste management during decommissioning at an ISR facility would be SMALL and would be similar to the respective construction and operational impacts. However, the volume of solid byproduct waste and all other types of solid wastes generated during decommissioning would be substantially greater than during the other phases due to the decontamination, dismantling, demolishing, and disposal of the Ross Project components (Strata, 2012a).

Liquid Waste

The Applicant estimates that less than 38 L/min [10 gal/min] of brine would be generated and disposed of by deep-well injection during the Proposed Action's decommissioning (Strata, 2012a). This volume would be a significant reduction from that generated during the other phases of the Proposed Action. The volume of used oil that would be generated during decommissioning and its management would be the same as that generated during operation (Strata, 2012a). The volume of domestic sewage that would be treated in the onsite system would be approximately 4,500 L/d [1,200 gal/d] (Strata, 2012a). Thus, the potential impacts of the management of liquid wastes during the decommissioning phase of the Proposed Action would be SMALL.

Solid Waste

The Applicant estimates that decommissioning would generate 3,000 m^3 [4,000 yd^3] of solid byproduct waste (Strata, 2012a). The nature of this waste is described in SEIS Section 2.1.1. A typical ISR Project generates approximately 4,593 m^3 [6,008 yd^3] of byproduct waste, and Strata would generate less, thus the analysis in the GEIS is bounding (NRC, 2009).

The onsite collection, minimization, and storage of this solid byproduct waste would follow the same techniques and SOPs as those described for the Proposed Action's operation. The pre-operational agreements with one or more appropriately licensed waste disposal facilities would govern the disposal of this waste the same as during the Ross Project's operation. The Applicant proposes to reduce the quantity of solid byproduct waste by decontaminating as many surfaces as technically possible while using decontamination techniques such as high pressure washing, sand blasting, and acid rinsing that allow waste volumes to be reduced (Strata, 2011a). Where possible, the Applicant intends to decontaminate equipment and building surfaces so that the mobile equipment, dismantled process equipment, and demolished building components could be reclassified for unrestricted use by demonstrating that radioactivity levels are below regulatory concern.

The Applicant estimates that decommissioning would generate 1,500 m^3 [2,000 yd^3] of solid non-byproduct waste. Such waste would consist of construction debris and decontaminated equipment and materials (Strata, 2012a). As described in Section 2.1.1 of this SEIS, the Applicant proposes this waste would be disposed of in local solid-waste landfills. The estimated volume of solid waste would be about twice the amount generated by the typical ISR facility described in the GEIS (NRC, 2009), however the capacity of the local landfills are shown in the Applicant's responses to the NRC's Requests for Additional Information and the Applicant's corresponding table indicates there would be sufficient local capacity for disposal of this volume (Strata, 2012a).

The volumes of other typical solid and hazardous wastes including industrial or municipal waste, recyclable, demolition, and petroleum contaminated soil generated during the Proposed Action's decommissioning would be similar to those generated during construction and operation (Strata, 2012a). The potential impacts of the management of solid wastes during decommissioning, therefore, would be SMALL.

4.14.2 Alternative 2: No Action

Under the No-Action Alternative, the Ross Project would not be licensed and the land would continue to be available for other uses. However, the Applicant could continue preconstruction activities until that decision has been made. Thus, drilling fluids and muds from drillholes and wells installed to delineate the ore zone and to characterize the ground-water and the geotechnical, subsurface conditions at the Ross Project area would continue to generate wastes under the No-Action Alternative. These wastes would continue to be contained in mud pits constructed at the well sites (as described in SEIS Section 2.1.1) and then evaporated to dryness. The dried pits would be backfilled, graded, covered with topsoil, and reseeded to achieve reclamation standards required by WDEQ/LQD (Strata, 2011a). No additional, distinct waste management impacts would result from the No-Action Alternative; thus, the potential impacts of waste management in the No-Action Alternative would be SMALL.

4.14.3 Alternative 3: North Ross Project

Under Alternative 3, the North Ross Project would generally be the same as the Proposed Action, except that the facility (i.e., the CPP, associated buildings, and auxiliary structures as well as the surface impoundments) would be located to the north of where it would be located in the Proposed Action, as described in SEIS Section 2.1.3. The wastes generated during this Alternative would be essentially the same as those generated during the Proposed Action during each of its phases: Alternative 3 would be constructed and operated the same as the Proposed Action, and its aquifer restoration and decommissioning would also be the same. Thus, the waste-management techniques and disposal strategies employed for the Proposed Action would be employed for Alternative 3.

However, as described in SEIS Section 2.1.1, the lined surface impoundments would not require the construction of the CBW included in the design of the Proposed Action because of the south site's higher water table. Consequently, the volume of liquid wastes generated at north site would be reduced by the volume of any leaks and/or ground water that would need to be dewatered from inside the CBW during facility operation, aquifer restoration, and decommissioning of Alternative 1. In addition, the volume of solid waste ultimately requiring disposal would be reduced by the small amount of material generated during the breach of the CBW during decommissioning. Therefore, potential impacts of waste management for Alternative 3 would be SMALL.

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5 CUMULATIVE IMPACTS

5.1 Introduction

The Council on Environmental Quality's (CEQ's) *National Environmental Policy Act* (NEPA) regulations, as amended (Title 40 *Code of Federal Regulations* [CFR] Parts 1500 – 1508) (40 CFR Parts 1500 – 1508), define cumulative effects as "the impact on the environment that results from the incremental impact of the action when added to other past, present, and reasonably foreseeable future actions regardless of what agency (Federal or non-Federal) or person undertakes such other actions" (40 CFR Parts 1500 – 1508). Cumulative impacts can result from individually minor, but collectively significant, actions that take place over a period of time. (For the purposes of this analysis, the phrase "cumulative impacts" is synonymous with the phrase "cumulative effects.") A proposed project could contribute to incremental cumulative impacts when its environmental impacts overlap with those of other past, present, or reasonably foreseeable future actions in a given area. For this Supplemental Environmental Impact Statement (SEIS), other past, present, and future actions near the Ross Project include (but are not limited to) cattle and sheep grazing, agricultural production, other uranium-recovery production, coal mining, oil and gas production, and wind-farm operation.

This analysis of the cumulative impacts of the Proposed Action is based upon publicly available information on existing and proposed projects, information in the Generic Environmental Impact Statement (GEIS) (NRC, 2009), and general knowledge of the conditions in Wyoming and in the nearby communities. The primary activities currently taking place in the area of the Ross Project are mineral mining and uranium recovery as well as oil and gas development. The Power River Basin contains the largest deposits of coal in the United States as well as significant reserves of other natural resources including uranium, oil, and gas (NRC, 2010). There has been a resurgence in interest in these mining and recovery activities.

This section evaluates the potential for cumulative impacts associated with the Ross Project and other past, present, and reasonably foreseeable future actions as described below in Section 5.2. The GEIS provides an example methodology for conducting a cumulative-impacts assessment (NRC, 2009). This methodology, which has been used by U.S. Nuclear Regulatory Commission (NRC) staff in its cumulative-impact analysis in this SEIS, is discussed in Section 5.3.

5.2 Other Past, Present, and Reasonably Foreseeable Future Actions

The Ross Project area, where the Proposed Action would be sited, is located just within the Nebraska-South Dakota-Wyoming Uranium Milling Region (NSDWUMR) as defined in the GEIS (NRC, 2009). The Ross Project encompasses approximately 697 ha [1,721 ac] of land, all of which is located in Crook County. It is located within the Lance District (see Figure 2.1 in Section 2), so-called due to its location above the uranium-rich Late Cretaceous Lance Formation as discussed earlier in Section 3.4. The surface owners of the Ross Project area include private parties (553 ha [1,367 ac]), the State of Wyoming (127 ha [314 ac]), and the U.S. Bureau of Land Management (BLM) (16ha [40 ac]). The subsurface-mineral owners include the same parties, except that of 553 ha [1,367 ac] of privately owned land, 65 ha [161 ac] of subsurface mineral rights are administered by BLM. Somewhat unusually, the surface water at the Ross Project predominantly flows in a northeasterly direction to the Little Missouri River, while the ground water, which is part of the Powder River Basin regime, flows mostly westerly. This bifurcation is important to note as cumulative impacts are identified and evaluated. The Ross Project area, at approximately 7 km^2 [somewhat less than 3 mi^2] in size, represents approximately 0.03 percent of the 25,900 km^2 [10,000 mi^2] of the entire Powder River Basin.

5.2.1 Actions

The historical and current actions (land uses) on and near the Ross Project area include livestock grazing, crop cultivation and agriculture, wildlife habitats, oil recovery, and, to the northeast, bentonite mining (Strata, 2011a). The historical Nubeth Joint Venture (Nubeth) also was operated on the lands, which comprise the proposed Ross Project. SEIS Section 3.2 discusses these historical and present land uses in more detail; these land uses are expected to continue into the future, albeit to a lesser extent, while the Ross Project is operating in the area. It should be noted that no long-term, permanent changes to the environment are anticipated as a result of the Ross Project within about 8 km [5 mi] of the Ross Project area, except for the potential installation of additional roads. The extensive aquifer restoration and site reclamation activities the Applicant would perform during the Ross Project's decommissioning would ensure that no permanent land-use changes occur on the Ross Project area itself.

Several industries presently conduct activities in and near Crook County, activities which could have environmental impacts that, when combined with those of the Ross Project, could be greater than the individual impacts of the Ross Project. In addition, some of these activities, such as uranium recovery as well as oil and gas recovery, could be actively expanded within Crook County and into its neighboring counties. These activities are described below.

5.2.1.1 Uranium Recovery

Uranium was first mined in Wyoming in 1920. Uranium discovered in the Powder River and Wind River Basins during the 1950s, and continued exploration for uranium resulted in discovery of additional sedimentary uranium deposits in the major basins of central and southern Wyoming, including the Powder River Basin. Continued uranium exploration resulted in discovery of additional sedimentary uranium deposits in the major basins of central and southern Wyoming. Uranium production in Wyoming declined in the mid-1960s, but increased again in the late 1960s and 1970s. Conventional mine production peaked in 1980 and then decreased in the early 1980s through the early 1990s when in situ recovery (ISR) facilities were developed. The total uranium mine production in the United States in 2007 was 2.1 million kg [4.5 million lb], almost half of which occurred in the southernmost Powder River Basin. ISR replaced conventional mining and milling as the preferred means for extracting uranium in the U.S. Currently, only ISR facilities are extracting uranium in Wyoming.

Interest in uranium-recovery has translated into several ISR projects in Wyoming. The Ross Project is one. In addition, the Applicant indicates that it could develop at least four additional satellite uranium-recovery areas within the larger Lance District over the next few years. Several other ISR projects are currently licensed in Wyoming as well, with two facilities operating and two ready for construction in the Powder River Basin (see Figure 5.1). None of these operating and/or licensed ISR projects are located in Crook County (the location of the proposed Ross Project) nor have any other Crook County ISR facilities be officially proposed to the U.S. Nuclear Regulatory Commission (NRC). However, four ISR projects are reportedly in the very early stages of development in Crook County (Strata, 2012a). In addition, two licensed ISR facilities are located in adjacent Campbell County (satellite areas of the Smith Ranch ISR Project, which is currently operating, and the Moore Ranch, which is still to be constructed). Two other ISR facilities overlap both Campbell and Johnson Counties (Willow Creek, which is currently operating, and Nichols Ranch, which is licensed and under construction).

The Applicant describes in its license application the types and sequence of its planned development of the Lance District. The Applicant has identified significant uranium resources within the District, and it intends for the Ross Project to be the first of several ISR areas. These potential satellite areas could consist of those shown in Figure 2.2 in SEIS Section 2.1.1, including, to the north, Ross Amendment Area 1 and, to the south end of the Lance District, the Kendrick, Richards, and Barber satellite areas (Strata, 2012a). If additional wellfields were to be developed by the Applicant and licensed by the NRC, the Ross Project's Central Processing Plant (CPP) would be used to process pregnant solutions from these satellite areas into yellowcake. In addition, the Applicant also proposes that ion-exchange (IX) resins loaded with uranium would be accepted at the Ross Project's CPP from other offsite ISR facilities (referred to as "toll milling") or companies and/or from water-treatment plants (Strata, 2011a). This additional potential use of the CPP at the Ross Project is the reason that the Plant is designed for four times the capacity needed for only the Ross Project.

<u>Lance District</u>

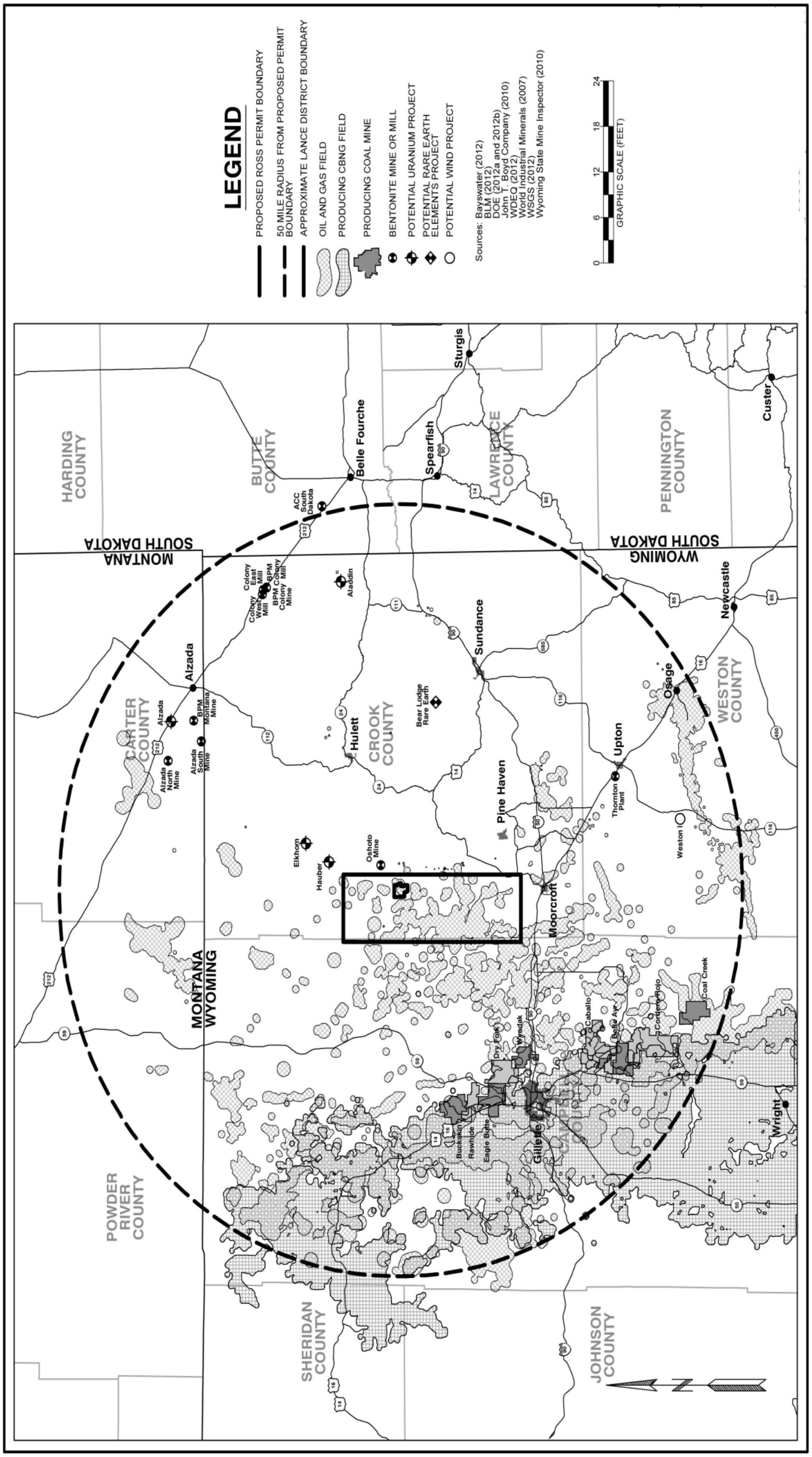
The four satellite areas within the Lance District that the NRC staff identifies as reasonably foreseeable are as follows:

Ross Amendment Area 1

This area would be an extension of the proposed Ross Project to the north and west. This area would not increase the overall production rate of yellowcake, but rather it would increase the operating life of the Ross Project. As uranium production from early wellfields within the Ross Project area begins to diminish and the wellfields begin to enter the aquifer-restoration phase of the proposed Project, additional wellfields in the Ross Amendment Area 1 could be brought into production by the Applicant. The Ross Amendment Area 1 could extend the lifetime of the Ross Project by several years as shown in Figure 5.4 (Strata, 2012a).

Kendrick Satellite Area

The Kendrick satellite area would be contiguous to the Ross Project area as shown in Figure 2.2 in SEIS Section 2.1.1. However, unlike the Ross Amendment Area 1, the Kendrick satellite area would allow the Applicant to increase its production of yellowcake to approximately 680,000 kg/yr [1.5 million lb/yr] (Strata, 2012a).



Source: Strata, 2012a.

Figure 5.1
Eighty-Kilometer- (Fifty-Mile-) Radius Area around Ross Project Area

Richards Satellite Area

The Richards satellite area would be contiguous to the Kendrick satellite area. The uranium-rich solutions extracted from this satellite area would be piped to the Ross Project's CPP for uranium recovery or, potentially, piped to the Barber satellite area as described below (Strata, 2012a).

Barber Satellite Area

Although the Applicant's plans for development of the Lance District are not yet complete, Strata anticipates that a remote IX-only plant could be constructed at the Barber satellite area. This would mean that the pregnant, uranium-rich solutions brought to the surface at the Barber satellite area would be treated by IX to yield uranium-loaded resins, which would then be trucked to the Ross Project's CPP for further processing (e.g., resin elution) (Strata, 2012a). This additional uranium would increase the CPP's output to approximately 993,000 kg/yr [2.19 million lb/yr]. In addition, the Applicant would investigate the possibility of transferring pregnant solutions from wellfields in the Richards satellite area to the remote IX facility at the Barber satellite area before transfer to the CPP at the Ross Project area.

<u>Other Potential ISR Facilities within 80 Kilometers [50 Miles] of the Ross Project</u>

There are no uranium recovery or nuclear-fuel-cycle projects currently located within 80 km [50 mi] of the Ross Project area nor have any Letters of Intent or license applications been filed with the NRC for any ISR projects within 80 km [50 mi] (Strata, 2011a; NRC, 2013). An 80-km [50-mi]-radius area from the Ross Project is shown in Figure 5.1. There are, however, four other uranium-recovery operations in various very early planning stages located within 80 km [50 mi] of the Ross Project, including the following:

Potential Aladdin Project

This potential ISR Project would be located in Crook County, approximately 66 km [41 mi] east-northeast of the Ross Project, although the driving distance to this project would be approximately 113 km [70 mi]. The Aladdin Project is being considered by Powertech Inc. and comprises approximately 7,099.8 ha [17,554 ac].

Potential Elkhorn Project

This potential ISR Project is currently being evaluated by NCA Nuclear, Inc. (a wholly owned subsidiary of Bayswater Uranium Corporation). This Project would also be located in Crook County, approximately 26 km [16 mi] from the Ross Project (driving distance would be approximately 32 km [20 mi]). It is currently estimated that this Project's area of 2,110 ha [5,215 ac] may ultimately yield approximately 544,000 kg [1.2 million lb] of uranium. The Project is located near the former, and decommissioned, Homestake Hauber Uranium Mine (see below).

Potential Hauber Project

The potential Hauber ISR Project would also be owned by NCA Nuclear, Inc., in a joint venture with Ur-Energy Inc. This Project would be located approximately 23km [14 mi] from the Ross

Project area, or 32 km [20 mi] if driven, and would comprise approximately 469 ha [1,160 ac]. The total uranium production from this Project is estimated at 680,000 kg [1.5 million lb] (Strata, 2012a). This Project would be located near the now-closed Hauber Uranium Mine, which was operated between 1958 and 1966 (Strata, 2011a), which is discussed below.

Potential Alzada Project

This Project would be owned and operated by NCA Nuclear, Inc. and would comprise approximately 10,000 ha [25,000 ac]. It would be located approximately 62 km [39 mi] north-northeast of the Ross Project area (driving distance would be approximately 129 km [80 mi]) (Strata, 2012a).

<u>Other ISR Facilities within the Powder River Basin</u>

There are four ISR projects in various stages of NRC's licensing process and/or currently operating or being constructed within the Powder River Basin, all of which are located in Wyoming. The 80-km [50-mi] cumulative-impacts area does not include the entire Powder River Basin. Two of these facilities are currently operating; two have been licensed, one of which has begun construction. The owner of a fifth ISR project has conveyed a Letter of Intent to submit a license application to the NRC, but the application has not yet been submitted. These ISR projects include the following:

Smith Ranch ISR Project

This is a uranium-recovery project currently being operated by Power Resources Inc. (dba Cameco Resources Inc. [Cameco]). The Smith Ranch ISR Project is primarily located in Converse County, Wyoming, but the operation includes several remote satellite areas in other Wyoming counties that are not located in the Powder River Basin. A license application to renew and to expand Source Materials License SUA-1548 for the Smith Ranch Project was received by the NRC in February 2012 (see Docket No.40-8964). If the NRC grants a license as proposed, the renewed license would allow Cameco to continue conducting ISR activities at its Smith Ranch Project as well as to initiate and/or expand ISR activities at its associated and remote ISR satellite areas: 1) the Highlands Uranium Project and the Reynolds Ranch ISR satellite areas, both also located in Converse County; 2) the Gas Hills ISR satellite area in Fremont and Natrona Counties, Wyoming; 3) the North Butte ISR satellite area in Campbell County, Wyoming; and 4) the Ruth ISR satellite area in Johnson County, Wyoming (NRC, 2013).

Willow Creek ISR Project

The Willow Creek ISR Project is located in Johnson County in Wyoming. This Project is owned by Uranium One (see Docket No. 40-8502). Currently, its NRC license is in timely renewal as of May 2008 (i.e., a renewal license application has been submitted and the NRC is currently engaged in technical review of that application).

A license application for the Ludeman ISR Project was originally submitted to the NRC in January 2010, but it was subsequently withdrawn in May 2010. A license application was resubmitted by the owner of the Project, Uranium One, in December 2011, where three specific subdivisions of the Ludeman area, which is located in Converse County, would be satellites of the Willow Creek ISR Project, which is located in Johnson County (NRC, 2013). Both of these Projects are situated in the Powder River Basin. The Ludeman ISR Project consists of approximately 8,000 ha [20,000 ac]; the Willow Creek ISR Project is approximately 5,500 ha [13,600 ac].

Nichols Ranch ISR Project

The Nichols Ranch ISR Project is located in Johnson and Campbell Counties of Wyoming. It is owned by the Uranerz Corporation (Uranerz) and is comprised of 1,251 ha [3,091 ac]. Its NRC license has been granted, and the facility is currently under construction (see Docket No. 40-9067) (NRC, 2013). Uranerz currently has an Underground Injection Control (UIC) Permit Application pending at Wyoming Department of Environmental Quality (WDEQ). Uranerz has signed a toll-milling agreement with the owner of the Smith Ranch ISR Project, Cameco, to transfer uranium-loaded IX resins from the Nichols Ranch ISR Project to the Smith Ranch Project for final processing to yellowcake.

Moore Ranch ISR Project

The Moore Ranch ISR Project is located in Campbell County, Wyoming; it is owned by Energy Metals Corporation, a wholly owned subsidiary of Uranium One. It is comprised of approximately 2,879 ha [7,110 ac]. It is currently licensed by the NRC to operate through September 2020 (see Docket No. 40-9073) (NRC, 2013); construction on this ISR facility has not yet begun.

Reno Creek ISR Project

AUC LLC, submitted a Letter of Intent to the NRC on November 3, 2010, indicating AUC LLC's intention to site, design, license, construct, and operate an ISR facility in Campbell County, Wyoming. According to publically available information, the NRC currently anticipates receiving AUC LLC's license application in April 2012 (NRC, 2012c).

Table 5.1 presents these Projects and indicates the respective linear distances from the Ross Project; Figure 5.1 shows these Projects' locations.

Table 5.1
Uranium-Recovery Projects within 80 Kilometers [50 Miles] of Ross Project Area

Project	Owner	County	Direction and Distance[a] (km [mi])	Status
Smith Ranch License SUA-1548 North Butte Ruby Ranch	Cameco Resources Inc./ Power Resources Inc.	Converse Campbell Campbell	SSW 180 km [110 mi]	Operating. Renewal and expansion (additional satellite areas) license application in technical review. Construction activities are occurring at the North Butte site. Ruby Ranch expansion license application not yet submitted.
Willow Creek (Formerly Irigaray/ Christianson Ranch) License SUA-1341 Ludeman Allemand-Ross	Uranium One	Johnson and Campbell Converse Converse	WSW 120 km [75 mi]	Operating. Renewal license application in technical review. Expansion to include Ludeman (license application has been submitted) and, later, Allemand-Ross (license application has not been submitted) satellite areas.
Nichols Ranch License SUA-1597	Uranerz Energy Corporation	Johnson and Campbell	SW 120 km [75 mi]	Licensed and under construction.
Moore Ranch License SUA-1596	Energy Metals Corporation/ Uranium One	Campbell	SW 150 km [90 mi]	Licensed, but not yet under construction.
Reno Creek	AUC LLC	Campbell		Letter of Intent filed, license application is not yet submitted.

Source: Strata, 2012a.
Note:
[a] Approximate distance from the Ross Project area to the respective ISR project in "as the crow flies" (i.e., straight line) in kilometers [miles].

Past ISR Facilities within 80 Kilometers [50 Miles] of the Ross Project

In addition to the present and reasonably foreseeable uranium-recovery facilities described above, it should be noted that, historically, two uranium-recovery facilities were located in the 80-km [50-mi] area surrounding the Ross Project area. The first was a historic uranium mine near Hulett, and the second, Nubeth, was identified above and has been included in this SEIS's analysis of pre-licensing baseline data as well as cumulative impacts in this section.

The historic Homestake Hauber Uranium Mine was operated by the Homestake Mining Company between 1958 – 1966; the mine closed in 1966. It is also located in Crook County, approximately 19 km [12 mi] to the northeast of the Ross Project. This mine is no longer a contributor to cumulative impacts in the area because it is not operating and, thus, no longer producing impacts related to traffic, water resources, air quality, noise, and so forth. However, it is now a part of the area currently being explored for additional potential uranium recovery by NCA Nuclear, Inc., in a joint venture with Ur-Energy Inc. The potential Hauber ISR Project is described above; the Project is currently in the planning stages. This Project would be the nearest ISR uranium-recovery project to the proposed Ross Project

Nubeth was described in SEIS Sections 2.1.1 and 3.5.3. This research and development ISR uranium-recovery operation operated between 1978 – 1986. Nubeth was decommissioned according to NRC and WDEQ requirements, and final approval for its decommissioning was issued between 1983 – 1986. Additional information regarding potential impacts from this historical operation is included in this SEIS Section assessing cumulative impacts.

5.2.1.2 Mining

Both coal as well as other natural resources are mined in and around Crook, Weston, and Campbell counties. Indeed, Powder River Basin coal mines supplies over 96 percent of the coal produced in Wyoming each year (BLM 2005a; BLM 2005b; BLM2005c), and Wyoming produces the greatest amount of coal in the U.S. Thus, substantial mining activities occur throughout the Basin, and coal mining continues to be the most prolific mining activity in the region.

Coal Mining

Coal mining in the Powder River Basin began during 1883, and underground coal mines began operation during 1894. The Powder River Basin emerged as a major coal-production area during the 1970s and early 1980s. The largest area, the Gillette coalfield, is approximately 24 km [15 mi] wide and extends from approximately 35 km [22 mi] north of Gillette, Wyoming, to approximately 40 km [25 mi] south of Wright, Wyoming. A second coal area is approximately 32 km [20 mi] wide, extending from Sheridan, Wyoming, north to the Wyoming-Montana state line. In 2007, this region accounted for approximately 97 percent of Wyoming's production and hosted the 10 largest coal mines in the U.S. Coal production in the Wyoming portion of the Basin is expected to grow at an annual rate of 2 – 3 percent per year. Additional coal leases and associated lands may be required to keep up with the world's demand (BLM, 2009e).

The Powder River Federal Coal Region was decertified as a federal coal production region by the Powder River Regional Coal Team in 1990, which allowed leasing to occur in the region on an application basis. Because of decertification, United States coal production increased 11 percent, from 900,000 t [1 million T] in 1990 to 1.1 million [1.2 million T] in 2007 (BLM 2009a). From 1990 to 2008, the BLM Wyoming State Office held 25 competitive lease sales and issued 19 new federal coal leases containing more than 5.7 billion tons of coal using the “lease by application” process (BLM 2005a; BLM 2005b; BLM 2005c). In 2003, the cumulative disturbed land area attributable to coal mines within the Powder River Basin totaled nearly 28,000 ha [70,000 ac]. Reasonably foreseeable future development projects contributing to the estimate of the cumulative acreage disturbed range from 47,400 – 50,600 ha [117,000 – 125,000 ac] in 2015. Other development related to coal includes railroads, coal-fired power plants, major (230 kV) transmission lines, and coal technology projects. The total land area of other coal-related disturbance in the Powder River Basin in 2003 was nearly 2,000 ha [5,000 ac].

Within 80 km [50 mi] of the Ross Project there are nine active coal mines (Strata, 2012a). Table 5.2 lists surface coal mines within 80 km [50 mi]; the respective locations are shown in Figure 5.1.

Table 5.2
Active Coal Mines within 80 Kilometers [50 Miles] of Ross Project Area

Mine Name	Owner	Straight-Line Distance km [mi]	Driving Distance km [mi]
Belle Ayr Mine	Alpha Coal West, Inc.	64 [40]	103 [64]
Buckskin Mine	Buckskin Mining Company	47 [29]	108 [67]
Caballo Mine	Peabody Caballo Coal L.L.C.	63 [39]	109 [68]
Coal Creek Mine	Thunder Basin Coal Co. L.L.C.	72 [45]	137 [85]
Cordero Rojo Mine	Cloud Peak Energy/ Cordero Rojo Mine	68 [42]	119 [74]
Dry Fork Mine	Western Fuels Wyoming Inc.	45 [28]	85 [53]
Eagle Butte Mine	Alpha Coal West Inc.	48 [30]	93 [58]
Rawhide Mine	Peabody Energy Rawhide Mine	47 [29]	100 [62]
Wyodak Mine	Wyodak Resources Development	45 [28]	71 [44]

Source: Wyoming State Mine Inspector, 2010; BLM, 2012, as included in Strata, 21012a.

Bentonite Mining

Bentonite is weathered volcanic ash that is used in a variety of products, including drilling muds and cat litters, because of its absorbent properties. There are 10 bentonite-producing mines in in the 80-km [50-mi] area surrounding the proposed Ross Project area. One, the Oshoto Mine, is 8 km [5 mi] (driving distance) from the Ross Project area. The next two closest bentonite mines are approximately 56 – 69 km [35 – 43 mi] from the Ross Project area.

Other Mining

Sand, gravel, and clinker (or "scoria") have been and continue to be mined in the Powder River Basin. Aggregate, which is sand, gravel, and stone, is used for construction purposes. The largest aggregate operation is located in the Powder River Basin in northern Converse County, and it has an associated total disturbance area of approximately 27 ha [67 ac], of which 1.62 ha [4 ac] have been reclaimed. Scoria is used as aggregate where alluvial terrace gravel or in-palace granite/igneous rock is not available. Scoria generally is mined in Converse and Campbell Counties, in the western portion of the Powder River Basin (BLM, 2005a; BLM, 2005b; BLM, 2005c). None of these are within 80 km [50 mi] of the Ross Project area.

Table 5.3
Active Bentonite Mines within 80 Kilometers [50 Miles] of Ross Project Area

Mine Name	Owner	Straight-Line Distance km [mi]	Driving Distance km [mi]
ACC South Dakota	American Colloid Company	74 – 80 [46 – 55]	129 [80]
Alzada North	American Colloid Company	56 – 65 [35 – 40]	89 [55]
Alzada South	American Colloid Company	56 – 65 [35 – 40]	72 [45]
BPM Colony Mill	Bentonite Performance Minerals L.L.C.	71 [44]	151 [94]
BPM Colony Mine	Bentonite Performance Minerals L.L.C.	71 [44]	151 [94]
BPM Montana	Bentonite Performance Minerals L.L.C.	56 – 64 [35 – 40]	72 [45]
Colony East Mill	American Colloid Company	71 [44]	151 [94]
Colony West Mill	American Colloid Company	69 [43]	151 [94]
Oshoto Mine	Black Hills Bentonite	5 [3]	8 [5]
Thornton Plant	Black Hills Bentonite	56 [35]	69 [43]

Source: Wyoming State Mine Inspector, 2010; WDEQ, 2012; BLM, 2008; BLM, 2011 as cited in Strata, 2012a.

Oil and Gas Production

Regional oil and gas development activities (e.g., exploration, production, and pipeline development) could have the potential to generate cumulative impacts (BLM, 2005b) when evaluated in conjunction with the Ross Project. There are approximately 472 oil and gas production units evenly dispersed throughout the Powder River Basin in various stages of production. The Wyoming Oil and Gas Conservation Commission reported that in 2003, oil and gas wells in the Powder River Basin produced approximately 113 million barrels of oil and 1.1 billion m^3 [40 billion ft^3] of conventional gas (BLM, 2005a; BLM, 2005b; BLM, 2005c).

Most of Wyoming current oil production is from old oil fields with declining production and the level of exploration drilling to discover new fields has been low (BLM, 2005a). From 1992 to 2002, oil production from conventional oil and gas wells in Campbell and Converse Counties within the Powder River Basin decreased approximately 60 percent. Oil- and gas-related development includes major transportation pipelines and refineries. In 2003, the cumulative disturbed land area in the Powder River Basin from oil and gas, coal-bed methane (CBM), and related development was nearly 76,081 ha [188,000 ac]. The corresponding projection for the year 2015 is 123,429 ha [305,000 ac] (BLM, 2005a; BLM 2005b; BLM, 2005c). The depth to producing gas and oil-bearing horizons generally ranges from 1,219 – 4,115 m [4,000 – 13,500 ft], but some wells are as shallow as 76 m [250 ft] (BLM, 2005a; BLM, 2005b; BLM, 2005c).

There are three oil-producing wells on the Ross Project area itself in addition to three oil-field water-supply wells and two injection wells. These are used for enhanced oil recovery (EOR) and were discussed during this SEIS's evaluation of ground-water impacts in Section 4.5.1. Figure 3.2 indicates the locations of all of the oil- and gas-producing wells in a 3-km [2-mi] radius of the Ross Project area.

Coal-Bed Methane Development

Natural gas production has been increasing in Wyoming. CBM is located where there are abundant coal resources. For this reason, the majority of CBM production in Wyoming occurs in the Powder River Basin. Annual CBM production in the Powder River Basin increased rapidly between 1999 and 2003, with nearly 15,000 producing CBM wells in the Powder River Basin in 2003 and a total production volume of 10.3 billion m^3 [364 billion ft^3] (BLM, 2005a; BLM, 2005b; BLM, 2005c). However, there are no CBM-producing wells in the 80-km [50-mi] radius vicinity of the Ross Project area. This is because the local stratigraphy at the Ross Project area falls below the Wasatch and Fort Union Formations where CBM production occurs (Strata, 2012a).

Wind Power Development

While there is potential in the Powder River Basin for wind-power generation to contribute to meeting forecasted electric power demands, they are dependent on 1) the location of sage-grouse core breeding areas and 2) available transmission capacity to send power to users. Both the location of Greater sage-grouse core breeding areas and transmission capability may be constraining factors (BLM, 2008; WOG, 2010). There are currently no wind power projects within the 80-km [50-mi] vicinity of the Ross Project area, and only one is proposed (see Figure 5.1) (Strata, 2012a).

This wind-power project, as proposed, would have a 250 MW capacity with 166 turbines generating approximately 600 million kWh annually (Strata, 2012a). It would be constructed and operated by Wind Energy America. This wind-power project would be located approximately 42 miles south-southeast of the Ross Project area, while it would be approximately 97 km [60 mi] to drive. It is south of I-90, where the Ross Project area is north of I-90.

5.3 Cumulative Impacts Analysis

5.3.1 EISs as Indicators of Past, Present, and Reasonably Foreseeable Future Actions

One indicator of present and reasonably foreseeable future actions (RFFAs) in a particular region of interest is the number of recent draft and final environmental-impact-statement (EIS) documents prepared by Federal agencies. The NRC used information in the GEIS, Section 5.1.1, as well as publicly available information, several site-specific EISs and SEISs for projects in the Powder River Basin, and draft and final programmatic EISs for large-scale actions related to several states including Wyoming to accomplish its cumulative-impacts analyses (NRC, 2009).

5.3.2 Methodology

For the determination of potential cumulative impacts, the NRC staff reviewed Appendix F of the GEIS and determined that a Level 2 cumulative effects analysis was appropriate for this SEIS due to the fact that concerns were identified during the site-specific analysis (SEIS Section 4) with respect to the sustainability or quality of some of the resource areas within the uranium milling region (NRC, 2009). Therefore, the following methodology was developed, based on CEQ guidance (CEQ, 1997) for a Level 2 cumulative effects analysis as described in the GEIS (NRC, 2009):

- Identify for each resource area the potential environmental impacts that would be of concern from a cumulative-impacts perspective. The impacts of the Proposed Action and the two Alternatives are described and analyzed by resource area in SEIS Section 4, Environmental Impacts and Mitigation Measures.
- Identify the geographic scope for the analysis of each resource area. This scope is expected to vary from resource area to resource area, depending on the geographic extent of the potential impacts.
- Identify the timeframe over which cumulative impacts would be assessed. The timeframe selected for this SEIS begins in approximately 2013, when the Applicant would receive a source material license from the NRC for the Ross Project, and includes any contemporary effects of past activities that persist at the Ross Project area. After receiving a license, the Applicant could begin facility construction and wellfield installation. After the NRC approves the Applicant's definition of its target background values (for excursion detection and aquifer restoration), the Applicant could begin operation. In general, the cumulative-impact analyses timeframes terminate in 2027, which represents the projected license termination data at the end of the decommissioning period (see Figure 2.6 in SEIS Section 2.1.1). In some resource areas, however, the NRC's analysis considers impacts beyond 2027 to the extent that some resources, such as ground-water resources, could require additional time to equilibrate after the complete decommissioning of the Ross Project.
- Identify past, existing, and anticipated future projects and activities in and surrounding the project area. These projects and activities are identified in this section.
- Assess the cumulative impacts for each resource area from the Proposed Action and reasonable alternatives and other past, present, and reasonably foreseeable future actions.

This analysis would take into account the environmental impacts of concern identified in Step 1 and the resource area-specific geographic scope identified in Step 2.

The following terminology was used to define the level of cumulative impact:

SMALL: The environmental effects are not detectable or are so minor that they would neither destabilize nor noticeably alter any important attribute of the resource considered.

MODERATE: The environmental effects are sufficient to alter noticeably, but not destabilize important attributes of the resource considered.

LARGE: The environmental effects are clearly noticeable and are sufficient to destabilize important attributes of the resource considered.

In conducting this assessment, NRC staff recognized that for many aspects of the activities associated with the proposed Ross Project, there would be SMALL impacts on affected resources. It is possible, however, that an impact that may be SMALL by itself, but could result in a MODERATE or LARGE cumulative impact when considered in combination with the impacts of other actions on the affected resource. Likewise, if a resource is regionally declining or imperiled, even a small individual impact could be important if it contributes to or accelerates the overall resource decline. The NRC staff determined an appropriate level of analysis that was merited for each resource area potentially affected by the Proposed Action and alternatives. The level of detailed analysis was determined by considering the impact level to that resource, as described in SEIS Section 4, as well as the likelihood that the quality, quantity, or stability of the given resource could be affected.

The subsequent sections document the NRC's cumulative impact analyses in the following areas:

- Land Use
- Transportation
- Geology and Soils
- Water Resources
- Ecology
- Air Quality
- Global Climate Change and Greenhouse-Gas Emissions
- Noise
- Historical, Cultural, and Paleontological Resources
- Visual and Scenic Resources
- Socioeconomics
- Environmental Justice
- Public and Occupational Health and Safety
- Waste Management

5.4 Land Use

The geographic area within which cumulative impacts to land use were evaluated were Crook and Weston counties, which are within the BLM's Newcastle Field Office planning area, and Campbell County, which is within the planning area administered by the BLM Buffalo Field Office (see Figure 2.1 in SEIS Section 2). These three counties include over 26,000 km^2 [10,000 mi^2] and incorporate the approximately 42 km^2 [25 mi^2] of the Ross Project area. These three counties serve as the geographic boundary area where socioeconomic factors that could relate to land use (i.e., within commuting distance, within shopping distance, and/or within lodging or new home construction distance) would occur. This area is referred to in this section as the "land-use cumulative-impacts study area." Thus, the Ross Project would be approximately 1/4 of 1 percent of the entire land-use cumulative-impacts study area. The timeframe for this cumulative-effects analysis is from 2013, when the Applicant could be issued a license by the NRC, through 2027, when the Ross Project would be completely decommissioned and the aquifers would have been restored.

Land use within the Powder River Basin is diversified and cooperative, with CBM as well as oil and gas extraction activities sharing the land with livestock. Although Federal grasslands and forests cover approximately 21 percent of the Powder River Basin area, most rangeland is privately owned (68 percent) and is used primarily for grazing cattle and sheep. In Crook County, the land ownership is also primarily private. Within Campbell County, however, land ownership is primarily Federal and is allocated by BLM for use as pasture (see Figure 5-5).

As noted in SEIS Section 3.2, the land-use impacts of the Ross Project would result primarily in the interruption, reduction, or impedance of livestock grazing and wildlife habitat; there is not public access to the area generally (e.g., for hunting or fishing) nor is there significant agriculture occurring currently at the Ross Project area (see Table 2.1 in SEIS Section 2.1.1). There are no longer any impacts from historical operations at the Ross Project area (i.e., Nubeth.) In addition, the area that would be disturbed by the Ross Project encompasses a total of 113 ha [280 ac] of land, which represents 16 percent of the Ross Project area. The permanent impacts of the Ross Project would be limited, because the Applicant would be required to return the land to the post-licensing, pre-operational conditions described in SEIS Section 2.1.1.2, unless the respective landowners wish to have certain roads, for example, remain. Thus, the potential land-use impacts from the Ross Project would be temporary and SMALL through all of its phases, as discussed in SEIS Section 4.2.

Mining in the form of coal, mineral, oil, and gas production are all important land uses of the cumulative-impacts study area. As noted Section 5.2, both conventional and CBM oil and gas production are expected to continue in upcoming years. As of 2010, there were over 2,600 conventional oil- and gas-well permits in the land-use cumulative-impacts study area (USGS, 2011), with 889 producing wells (or less than 1 producing well per 26 km^2 [10 mi^2]. A typical drilling location, including the access road, disturbs approximately 1.11 ha [2.75 ac] of land; at a density of 1 well per 26 km^2 [10 mi^2], this would represent up to 0.04 percent of the land affected by these wells. In addition, over 1,570 of the permitted wells have been abandoned and are no longer being used. Through 2008, 547 CBM wells had been drilled within the three-county study area (or approximately one producing well per 52 km^2 [20 mi^2], affecting approximately 0.02 percent of the total land area) (USGS, 2011). Because of the small area of impact for each well and the moderate number of wells currently being operated, the cumulative impacts of the use of land for oil and gas production is SMALL.

As noted in Section 5.2, coal production in the Wyoming portion of the Powder River Basin is expected to grow at an annual rate of 2 – 3 percent per year. It is predicted that from 2010 to 2020, the land area impacted by coal development in the Powder River Basin will increase from 39,927 ha – 55,621 ha [98,662 ac – 137,443 ac]. By 2020, these impacts would represent 1.3 percent of the land in the Powder River Basin. However, most of this coal-mining growth would be in the central area of Campbell County and in an area where the nearest coal mine is over 45 km [28 mi] from the Ross Project area. In the 80-km [50-mi] area shown in Figure 5.1, there are 9 operating coal mines (Strata, 2012a). This coal-mining land use has and would continue to have a MODERATE impact in the land-use cumulative-impacts study area.

There are no operating nor licensed ISR facilities within 83 km [50 mi] of the Ross Project, although there are four uranium-recovery projects in the very early stages of development as described in SEIS Section 5.2 (i.e., Aladdin, Elkhorn, Hauber and Altzada). There is also a potential for development of other uranium facilities to the south of the Ross Project as part of the entire Lance District as described earlier. Thus, some land-use changes as a result of these reasonably foreseeable future developments could occur. To assess the projected land area that would be affected by the development of these present and foreseeable future actions, the NRC staff assumed that approximately the same area affected by the Ross Project and its disturbance of 113 ha [280 ac] would also be approximately the same as by these other ISR projects. Using this assumption, the NRC estimated that the four other non-Strata projects and the four other Strata Lance District projects would impact an additional 904 ha [2,240 ac], for a total area disturbed by potential ISR projects in the land-use cumulative-impacts study area of 1,017 ha [2,520 ac]. This acreage accounts for only approximately 0.04 percent of the total study area. Therefore, these ISR projects would have a SMALL impact on land use.

The NRC staff has concluded that the cumulative impacts on land use in the study area resulting from past, present, and reasonably foreseeable future actions is MODERATE. The Ross Project would have a SMALL incremental effect on land use when added to the MODERATE cumulative land-use impacts.

5.5 Transportation

An area with an 80-km [50-mi] radius was used as the geographic boundary in the evaluation of the cumulative impacts of transportation for this SEIS (referred to in this section as the “transportation cumulative-impacts study area”). This study area was selected because it incorporates the area that would likely be used by the majority of the workers at the Ross Project and includes the distance to the nearest Interstate highway (i.e., Interstate-90). The analysis of transportation-related cumulative impacts is the timeframe of 2013 – 2027, which would be the entire lifecycle of Ross Project from licensing to final decommissioning. The analysis assumes that within this timeframe the four potential satellite areas within the Lance District would be developed sufficiently by the Applicant to begin construction and operation.

The environmental impacts identified in SEIS Section 4.3.1 for the Ross Project would result from the transport of chemical supplies, building materials, yellowcake product, vanadium product, solid byproduct wastes, other hazardous and nonhazardous wastes, and the commuting workforce, all of which increase traffic volumes to and from the Ross Project area. During the phases of the Ross Project examined in SEIS Section 4.3, traffic volume was estimated to increase up to 200 percent. This traffic would predominantly be present on the local Crook County roads. As a result, the wear and tear of the county roads would be significantly increased, and the potential for wildlife mortality and vehicular accidents would increase as well. Therefore, the transportation impacts were found to be SMALL TO LARGE, as discussed in Section 4.3. With the mitigation measures discussed in Section 4.3, the transportation impacts would be reduced to SMALL to MODERATE. Once the Ross Project is decommissioned, most wellfield roads constructed as part of the Ross Project would be removed, and the traffic volume would subside to a little more than the 2010 volume.

Direct impacts to the roads and highways within the transportation cumulative-impacts study area include increased vehicular-traffic volumes and increased risk of vehicular accidents during daily commutes by workers and the trips their families take, especially on roads such as New Haven and D Roads. Ross Project workers would use these roads as would workers from the Lance District satellite areas and two of the five potential ISR projects currently being planned. If the same workforce is assumed for the two other potential ISR projects; if they are assumed to be under construction at the same time; and if it is assumed that the workers at both the Elkhorn and Hauber projects were to use D or New Haven Roads to commute to and from work, this would increase D and New Haven Roads traffic to approximately and conservatively 920 additional automobiles on this road alone per day (it was assumed here that the Ross Project would be already in its operation phase and its workforce would have been reduced to 60 workers). In addition, all of the supply and materials deliveries during their construction phase and uranium-product shipments would need to be added to this traffic volume. The volume that results, assuming the same number of deliveries and shipments by the other ISR projects would rise to almost 1,000 vehicles per day. (Also, D Road is already being used by the Oshoto bentonite mine northeast of the Ross Site area, although there are only a reported eight workers currently commuting to that facility; consequently, this traffic was already considered under the Ross Project's transportation impacts in SEIS Section 4.3.) This would be a LARGE cumulative impact for D and New Haven Roads. Traffic on I-90 is expected to be similarly increased during this period. However, the Interstate highway has been designed to provide sufficient capacity for this increase (as discussed in SEIS Section 4.3). Thus, the transportation impacts on the Interstate-highway system of the U.S. would be SMALL.

All of indirect impacts identified for the proposed Ross Project, including increased wear and tear on existing roads, air emissions, fugitive dusts, noise, and risk of vehicle collisions with livestock, wildlife, and other vehicles, would occur as a result of this increased traffic volume on the county roads. This would be a MODERATE to LARGE impact.

The NRC staff has concluded that the cumulative impacts within the study area resulting from past, present, and reasonably foreseeable future actions is MODERATE to LARGE. The proposed Ross Project would have a SMALL to MODERATE incremental effect on transportation when added to the MODERATE to LARGE cumulative transportation impacts.

5.6 Geology and Soils

The geographic area for the evaluation of geology and soils cumulative impacts ("geology and soils cumulative-impacts study area") is defined as the approximately 9,000-ha [22,200-ac] Lance District shown on Figure 2.2 in SEIS Section 2.1.1. Limiting the cumulative impacts assessment for soils to this area is appropriate since geology and soil impacts are limited to the area in which they occur. The Ross Project itself would result in the disturbance of 113 ha [280 ac] of surface soil, a very small fraction of the total study area (i.e., approximately 0.013 percent).

Previous ISR activities at the Ross Project site include research and development activities conducted by Nubeth in the late 1970's. These activities included construction and operation of a small 5-spot wellfield for one year that likely resulted in some soil disturbance to a small area of land (Strata, 2011a). Regulatory approval of Nubeth's decommissioning was granted by 1986. The Nubeth area was restored and these past activities are consequently no longer relevant for the geology and soils cumulative impacts analysis.

As noted in Section 5.3.2, the proposed schedule for construction, operation, and decommissioning as well as the restoration of the aquifer(s) at the Ross Project show activities taking place over an approximate nine-year period from the time the Project would be licensed by the NRC (Strata, 2012a). The other Lance District wellfield-development activities (i.e., satellite areas) could extend the processing of loaded IX resins at the Ross Project's CPP by another five years or more (Strata, 2012a) to 2027 (see Figure 2.6 in Section 2.1.1). However, the geology and soils impacts within the Ross Project area where the soils would have been disturbed would need additional time to recover. These impacts would dissipate quickly once site restoration is complete, within five years or less; therefore, the time period for this geology and soils cumulative-impacts evaluation is 19 years from the licensing of the Ross Project, or the year 2032.

During the lifecycle of the Ross Project, as discussed in SEIS Section 4.4, potential impacts to Ross Project area geology would be predominantly associated with drillholes, wells, and wellfields. At the conclusion of the Ross Project, an average density of approximately 4.3 wells/ha [1.7 wells/ac], each properly plugged and abandoned, would remain. The Applicant's proper plugging and abandoning of these holes would mitigate their impact vis-à-vis the local geology. Also, the records required by the Applicant's permits for well plugging and abandonment would allow a final assessment of geology impacts after the Ross Project has been decommissioned, if necessary.

The most significant impacts for soils would be soil loss and compaction, soil-productivity loss, and potential soil contamination. There would also be soil disturbance associated with the construction of the CPP, surface impoundments, and access roads as well as pipeline and wellfield installation. Accidental releases of drilling fluids and muds, process solutions, and other liquids could cause soil contamination throughout the Project's lifecycle. As noted in SEIS Section 4.4, facility- and wellfield-design features, best management practices (BMP), and permit requirements, such as the Applicant's Permit to Mine, UIC, and Wyoming Pollution Discharge Elimination System (WYPDES) Permits would minimize these potential impacts during the Ross Project's construction, operation, aquifer restoration, and decommissioning. The Project's decommissioning would include reclamation of soils and the restoration of the site to baseline conditions. Baseline conditions have been documented by soils and vegetation surveys of the Ross Project area. The surveys have established a baseline conditions against which soils impacts at the Ross Project can be measured (see Figure 3.10).

Thus, the geology and soil impacts of the Ross Project would be SMALL in the geology and soils cumulative-impact study area.

To assess cumulative impacts to soils, the area of soil disturbances need to be quantified. The Applicant has identified four potential ISR satellite areas within the Lance District (see Figure 2.2 in SEIS Section 2.1.1) (Strata, 2012a). The NRC assumed that each of these satellite areas would require the same area of soil disturbance as the Ross Project; thus, their development would result in 450 ha [1,120 ac] of soil disturbance. The density of wells at the satellite facilities would be similar to the density at the Ross Project. The impacts to geology and soils would be mitigated as those at the Ross Project would, including complete site reclamation at the end of the Project's lifecycle. If the density of drillholes and wells at these areas would be the same as the Ross Project, and the requirements for plugging and abandonment of the holes would be the same, the potential impacts to geology and soils at each satellite facility would be generally equivalent to those of the Ross Project, which were determined to be SMALL.

As shown on Figure 5.1, there are numerous oil and gas fields that are located within the Lance District. There are no publicly announced plans for further oil and gas development in the area. The impacts to local geology would be the depletion of the oil and gas resources and the remaining, plugged wells after production. For soils, the current wells and any future wells would cause soil impacts due to the drilling of recovery wells, constructing new roads, and conducting other operating activities. These soil impacts would also be required to be mitigated with site-specific BMPs and site-restoration requirements.

The NRC staff has determined that the cumulative impacts to geology and soils in the geology and soils cumulative-impacts study area would be SMALL. The soil disturbance associated with the Ross Project area and the other satellite projects in the Lance District would be limited to approximately 5 percent of the approximately 9,000-ha [22,200-ac] Lance District with 95 percent of the area remaining undisturbed. This disturbance to geology and soils would be dispersed throughout the Lance District and site restoration would be required. The proposed Ross Project would have a SMALL incremental impact on the SMALL cumulative impacts to geology and soils in the geology and soils cumulative-impacts study area.

5.7 Water Resources

The analysis of the cumulative impacts to both surface and ground waters are described below.

5.7.1 Surface Water

The geographic area for the evaluation of surface-water cumulative impacts has been defined as Little Missouri River Basin, from the Ross Project downstream to the Wyoming/Montana border (see Figure 3.10 in SEIS Section 3.4.2). Within this stretch of the Little Missouri River, which begins in within the Ross Project area, the mean flow increases from an average of less than 0.05 m^3/s [1.7 ft^3/s] at SW-1, near the downstream Ross Project boundary, to an average of 2 m^3/s [77 ft^3/s] just downstream of the Wyoming/Montana border. The 45-fold increase in flow within 80 km [50 mi] indicates that cumulative impacts associated with the Ross Project could only be measured in the upper reaches of the Little Missouri River Basin, which is why this geographic area was selected for cumulative-impacts analysis. As the River's flow substantially increases downstream of the Ross Project, any cumulative impacts would be lessened by the additional volume of water.

As discussed in Section 5.3.2, the timeframe defined for the cumulative-impact analysis is 14 years after license issuance. The schedule shown in Figure 2.6 in SEIS Section 2.1.1 indicates that the construction, operation, aquifer restoration, and decommissioning of the Ross Project facility and wellfields would take place during this time period. Since the impacts of the Ross Project on surface-water flows and surface-water quality would dissipate quickly upon completion of the decommissioning phase, this cumulative-impact analysis for surface water ends at 2027 after final Ross Project decommissioning is complete.

The Ross Project would use surface water from the Little Missouri River for dust control and construction-related activities. The Applicant would need to obtain a WYPDES Permit for storm-water management and for the discharge of ground water from wells outside the exempted ore-zone aquifer during the Ross Project's lifecycle. As described in SEIS Section 4.5.1, the impacts to surface-water quantity would be minimal, and the potential water-quality impacts would be mitigated by BMPs, management plans, and permit requirements. The potential impacts of erosion in the small area of temporary land disturbance as well as from accidental process-solution and other liquid spills and leaks would be localized and short-term because of the management plans and standard operating procedures (SOPs) the Applicant would adopt. The potential impacts to the surface-water quantity and quality from the Ross Project would be SMALL.

With respect to wetlands, the Ross Project's construction would have the potential to impact up to 0.8 ha [2 ac] of wetlands. A USACE-required permit would oblige the Applicant to provide a site-specific mitigation plan for all Project-related disturbance of jurisdictional wetlands. This plan would ensure that appropriate mitigation measures would be in place so that there is no net loss of wetlands. As described in SEIS Section 4.5.1, the Ross Project's potential impacts to wetlands would be SMALL.

Measurements of pre-licensing baseline surface-water flows and baseline water-quality parameters provide the baseline characteristics for assessment of cumulative impacts to surface-water quantity and quality (Strata, 2011a). The monitoring program that the Applicant would implement during all phases of the Ross Project would ensure that the Applicant meets NRC license conditions and WDEQ/Land Quality Division's (LQD's) Permit to Mine requirements. This monitoring program is discussed in SEIS Section 6.

The cumulative impacts for surface water would be related to water quantity and water quality. All streams within the upper reaches of the Little Missouri River and for 67 km [40 mi] downstream of the Ross Project are classified by WDEQ/Water Quality Division (WQD) as 3B streams (i.e., intermittent or ephemeral stream incapable of supporting fish populations or providing drinking water). At the confluence with Government Canyon Creek (approximately 67 km [40 mi] downstream of the Ross Project area), the River's flow increases to the point that the stream classification changes to 2ABWW (i.e., it is protected as a drinking-water source and can support warm-water fisheries). Surface-water quality in the upper reaches of the Little Missouri River currently meet Wyoming's surface-water criteria for a Class 3B stream (Strata, 2011a). Current surface-water flows would define the baseline conditions against which impacts can be measured over time. Data on surface-water flows are available from three monitoring stations within the Ross Project area for 2010 and 2011 (Strata, 2012a). These data, combined with flow data from the Wyoming/Montana border would provide a dataset against which changes in surface-water flow can be evaluated.

Surface-Water Quantity

Strata's potential uranium-recovery satellite areas in the Lance District, as described in SEIS Section 5.2, could impact the Little Missouri River (Strata, 2012a). Of the four identified potential satellite areas, only the Ross Amendment Area 1 lies within the Little Missouri River Basin. The others are located within the drainage basin of the Belle Fourche River. However, because the uranium-recovery and water-treatment from the satellite areas would continue to occur at the Ross Project's CPP, these areas are considered in this evaluation of surface-water-quality cumulative impacts, later.

Crop irrigation and stock watering are the primary uses of surface water in the Wyoming portion of the Little Missouri River Basin (WWDC, 2002a). Irrigation use is estimated to range from 1,200 ha-m [9,700 ac-ft] to 1,400 ha-m/yr [11,600 ac-ft/yr] and evaporative loss from stock reservoirs is less than approximately 120 ha-m/yr [1,000 ac-ft/yr] (WWDC, 2002a). There are no other significant uses of surface water in the Wyoming portion of the Little Missouri River. The high estimate of current surface-water use is approximately 22 percent of the mean annual flow in the Little Missouri River at the Wyoming/Montana border (6,900 ha-m/yr [55,800 ac-ft/yr]). Agricultural uses of surface water in the northeastern portion of Wyoming are estimated to grow between 0 and 9 percent, or an increase up to 140 ha-m/yr [1,130 ac-ft/yr], over the next 30 years (WWDC, 2002a).

During the lifecycle of the Ross Project, the annual surface-water use for construction and dust control is estimated to range from 0.71 ha-m/yr [5.8 ac-ft/yr] to 4.6 ha-m/yr [37 ac-ft/yr]. If the Ross Amendment Area 1 were to be permitted and developed concurrently with the Ross Project, and if it were to use a similar quantity of water for construction and dust control, surface-water use would double. However, the potential for increasing water-quantity impacts would continue to be mitigated by BMPs, management plans, and permit requirements. The remaining Lance District potential uranium-recovery areas are expected to rely upon surface water from outside the Little Missouri River Basin.

Other projects that could potentially affect surface-water use within the surface-water cumulative-impacts study area (i.e., the Little Missouri Basin within Wyoming) are described as follows.

- ***Oshoto Mine***: Bentonite mining typically does not use surface water. Water quality could be impacted by sediments, due to erosion and runoff (see **Water Quality** below) (BLM, 2011).

The two uranium-recovery projects that have been identified for potential development within the Little Missouri River Basin are the Hauber and Elkhorn projects. Because there are no existing plans for these projects, the amount of surface water usage is unknown. However, the quantity of uranium targeted by each project has been used to scale and calculate the approximate water use by each, based upon the quantity of uranium reported to occur at each site.

- ***Hauber Uranium Project***: This project targets approximately 1.5 million pounds of U_3O_8, approximately 12 – 25 percent of the 3 – 6 million pounds targeted by the Ross Project. Thus, this project could use between 12 – 25 percent of the surface water the Ross Project would use.
- ***Elkhorn Uranium Project***: This project targets approximately 1.2 million pounds of U_3O_8, approximately 10 – 20 percent of the 3 – 6 million pounds targeted by the Ross Project.

This project would use between 10 – 20 percent of the surface water as the Ross Project would use.

The numerous oil- and gas-recovery projects identified in Figure 5.1 have been assumed to rely upon ground water for water supply and are not expected to impact surface-water quantity. In addition, the projected changes in agricultural and industrial uses of surface water over the next 14 years are predicted to increase surface-water use of the Little Missouri River from 22 percent to approximately 24 percent of the total flow in the Little Missouri River. Agriculture would account for about 1.8 percent increase. The two areas that the Applicant could develop (i.e., the Ross Project and the Ross Amendment Area 1) and the two other planned uranium-recovery projects, the Hauber and Elkhorn projects, all in the Little Missouri Basin, would account for a 0.2 percent increase over the current use. Thus, the cumulative impact, a two-percent decline in the flow of the Little Missouri at the Wyoming/Montana border, due primarily to an increase of agricultural withdrawals over the next 14 years, is small. In addition, the reduction in flow due to uranium-recovery projects would be short-term and minor compared to agricultural use. Thus, surface-water cumulative-impacts related to water quantity would be SMALL.

<u>Surface-Water Quality</u>

The water quality at the Ross Amendment Area 1 and the two uranium-recovery projects described above would also be protected by BMPs, management plans, and permit requirements. Increases in sediment and other water-quality parameters from uranium-recovery projects and other mining (bentonite) activities would be mitigated by the owner/operator implementing BMPs and management plans as well as complying with WYPDES Permits, WDEQ/LQD Permits to Mine, and NRC's license conditions that would be included if a license amendment for this satellite were to be issued to the Applicant. Increases in impacts to water quality from agriculture would be mitigated through compliance with Wyoming's Watershed Protection Program. Thus, the cumulative impacts to surface-water quality in the Little Missouri River Basin would be SMALL.

The cumulative impacts to water quantity and quality in the upper reaches of the Little Missouri River would be SMALL. The proposed Ross Project would contribute SMALL incremental impacts to the SMALL cumulative impact.

5.7.2 Ground Water

The geographic area for the cumulative-impact analysis of ground-water impacts was based upon the hydrogeology of the Lance and Fox Hills Formations within the Powder River Basin, the practical maximum depth for water-supply wells, and the availability of ground-water sources as alternatives to the Lance and Fox Hills Formations. As described in SEIS Section 3.5.3, the ore zone at the Ross Project area is within the lower interval of the Lance Formation and upper interval of the Fox Hills Formation, which are separated from the aquifers above and below by confining units. NRC's evaluation of cumulative effects is therefore limited to only the stratigraphic horizon targeted by the Ross Project, because the ore-zone aquifer is not in contact with aquifers above and below it.

The Black Hills Monocline east of the Ross Project area brings the Lance and Fox Hills Formations to outcrop. Recharge occurs primarily in the area of outcrop and where the Formations are directly below alluvium-filled drainages. The geographic extent for the "ground-water cumulative-impacts analysis study area" is therefore delimited by the extent of the outcrop of the Fox Hills Formation to the east and by the 0 m [0 ft] elevation contour of the top of the Fox Hills Formation to the west. Along the other Ross Project boundaries, the geographic extent is defined by the 80-km [50-mi] radius from the Ross Project.

The schedule for construction, operation, aquifer restoration, and decommissioning at the Ross Project indicates a period of 14 years, from the licensing of the Ross Project to its complete decommissioning (see Figure 2.6 in SEIS Section 2.1.1) (Strata, 2012a). Ground-water modeling demonstrates that 10 years after restoration is complete, ground-water levels would have nearly recovered to a pre-uranium-recovery state (Strata, 2011b). Thus, the time period of 24 years from the start of the Ross Project was defined for this cumulative-impacts evaluation (i.e., the year 2037). The Applicant estimates that recharge to the Lance Formation would be between 0.03 to 0.09 cm/yr [0.07 and 0.22 in/yr] (Strata, 2011b). Because of the limited Lance and Fox Hills Formations recharge area and their low recharge rates, small residual drawdowns in the vicinity of the Lance District would likely be present for tens of years after cessation of uranium-recovery activities.

The primary cumulative impacts for ground water would be related to both water quantity and water quality. During uranium-recovery at the Ross Project, there would be a net withdrawal of water from the ore-zone aquifer. This withdrawal rate would produce decreases in ground-water levels in Ross Project wellfields. Other ground-water users that operate wells completed in the same hydrostratigraphic unit would also affect water levels in the vicinity of their wells. Extraction of ground water in excess of the rate of recharge to the aquifer in the same hydrostratigraphic unit would result in the decline in ground-water levels with time. Upon termination of water extraction, however, recharge of the aquifer would then increase ground-water levels. As described in SEIS Section 4.5.1, the potential impacts to the ground-water quantity from the Ross Project would be SMALL as its consumptive use would be mitigated by alternative water supplies as necessary.

Data on ground-water levels and water-quality data are available for a number of wells within the Ross Project area from early 2010 (Strata, 2011a; Strata, 2011b; Strata, 2012a). These data, together with individual wellfield post-licensing, pre-operational baseline data that would be required as part of the NRC license, would provide a dataset against which changes in ground-water quality can be evaluated. Long-term observations of ground-water levels and ground-water monitoring within the hydrostratigraphic unit would provide a metric for assessing the cumulative ground-water quantity impacts. The monitoring program proposed by the Applicant to meet NRC and WDEQ/LQD Permit to Mine requirements are discussed in SEIS Section 6.

At the Ross Project area, ground-water flow is to the northwest, into the Powder River Basin. The top of the Fox Hills Formation is at approximately an elevation of 1,100 m [3,600 ft] in the area of the Ross Project. A review of ground-water resources in the Powder River Basin notes that ground-water quality and drilling economics generally limit the maximum depth of wells to less than 300 m [1,000 ft] (WWDC, 2002b). However, the City of Gillette does have wells approximately 1,050 – 1,350 m [3,500 – 4,500 ft] deep, tapping the Fox Hills Formation where the top of the Fox Hills Formation is at an elevation 150 m [500 feet] (WSGS, 2012). At this location, the high total dissolved solids (TDS) in the ground water requires it be mixed with waters from deep wells, which are located near Moorcroft; they are drilled into the Madison Formation, where fewer TDSs are present. Because both the depth to the Fox Hills Formation and the fact that TDS concentrations increase farther into the Powder River Basin, the municipal water-supply wells for Gillette mark the westernmost practical limit for extraction of potable water from the Ross Project's ore-zone aquifer. Therefore, the western edge of the ground-water area defined for cumulative-impact analysis is the 0 m [0 ft] structural contour, on the top of the Fox Hills Formation, which is located about 60 km [37 mi] west of the Ross Project area. At this point, the Fox Hills aquifer is approximately 1,200 – 1,500 m [4,000 – 5,000 ft] deep.

During the operation and aquifer-restoration phases of the Ross Project, the weighted average ground-water consumption has been estimated to be 462 L/min [122 gal/min] over a period of 6 years (Strata, 2011a). The Ross Project area has a predicted U_3O_8 production of 340,000 kg/yr [750,000 lb/yr] over 4 – 8 years, and the Ross Amendment Area 1 would extend this rate of production for several years (Strata, 2012a). Production would rise to 993,000 kg/yr [2.19 million lb/yr] U_3O_8 (i.e., yellowcake) with the Kendrick, Richards and Barber satellite areas. If consumptive water use is assumed to be proportional to U_3O_8 production, then ground-water consumption would increase to an average of 1,347 L/min [356 gal/min] over the period of maximum production within the Lance District. It is likely that ground-water drawdowns at the uranium-recovery wellfields in the Lance District would overlap both spatially and temporally.

As noted earlier, the Wyoming State Engineer's Office (SEO) maintains a database of ground-water rights, including water use, well yield, well location, and well depth; however, the geologic interval from which the ground water is extracted is not recorded. Furthermore, data on the yield may not be representative of the actual volumes pumped. Thus, the current rate of ground-water withdrawal from the Lance and Fox Hills formations, and in particular the ore-zone interval, cannot be estimated. The Applicant reviewed the Wyoming SEO's database and concluded that most of the permitted stock and domestic wells within the region of the Ross Project were completed within the Lance Formation sandstones above the ore zone and were not in hydrologic communication with the ore zone. The depth of the ore zone, typically greater than 120 m [400 feet], and the fact that there are other aquifers above the ore zone would make the ore-zone (OZ) aquifer unattractive as a ground-water source (Strata, 2011b). In addition, any future ground-water development of the Lance and Fox Hills aquifer system would be localized and limited, due to poor water quality (WWDC, 2002a).

There are a number of existing or potential resource-extraction projects within the ground-water cumulative-impacts study area that have water demands. These are:

- ***Uranium Recovery*:** Other existing or planned uranium-recovery projects are outside the specific geographic area selected for ground-water-related cumulative-impact analysis, and are in a different stratigraphic horizon than is the Ross Project (Strata, 2012a). The planned Aladdin, Elkhorn, Hauber, and Alzada uranium-recovery projects, if they come to fruition, would target uranium in the Fall River and Lakota Formations. These Formations are of lower Cretaceous age, located several thousand feet below the Lance and Fox Hills Formations, and are separated by the thick Pierre Shale. Thus, uranium-recovery activities in those Formations would not impact the same ground water at the Ross Project.

- **_Coal Mining and CBM Extraction_**: The mining of coal and extraction of CBM occur along the western margin of the geographic area (see Figure 5.1). The principal coal seams are in Tongue River Member of the Fort Union Formation, which is separated from the Lance and Fox Hills Formations by several thousand feet of the Upper Hell Creek and Lebo confining units (Hinaman, 2005). Ground-water pumping associated with CBM production, coal mining and processing, and mine-mouth power generation would therefore not impact ground water within the Lance and Fox Hills Formations.
- **_Bentonite Mining_**: Bentonite-mining operations take place in the shale intervals stratigraphically below the Lance and Fox Hills Formations and are, therefore, outside the geographic area for the analysis of ground-water cumulative impacts.
- **_Other Mining_**: Other potential mining projects, for example, the Bear Lodge Rare Earth project, are also outside the geographic area defined for ground-water cumulative impacts.
- **_Oil Recovery_**: In the mature oil fields of northeast Wyoming, water is used for EOR and is described as "water flooding" (De Bruin, 2007). At the Ross Project area, the Lance and Fox Hills aquifers show approximately 46 m [150 ft] of drawdown due to withdrawals by the three water-supply wells that have been used since 1980 for oil production (see SEIS Section 4.5.1) (Strata, 2011b). The oil-field water-supply wells within the cumulative-impacts study area would continue to be used during the period of active uranium recovery at the Ross Project. Only a portion of the water requirements, however, would be provided by the Lance and Fox Hills Formations, as stratigraphically higher aquifers are available in the western portion of this area.

<u>Ground-Water Quantity</u>

The NRC staff has determined that the cumulative impacts to ground-water quantity in the ground water cumulative-impacts study area would be SMALL. There would be no increases in water consumption for oil recovery, agriculture, or domestic uses in the Lance and Fox Hills Formations. The drawdown from the pumping of water for EOR is expected to be greater than any of the other uses in areas where the Lance and Fox Hills aquifers supply water for oil-production activities. The effects on ground-water quantity from uranium recovery in the Lance District would also be essentially restored within 24 years after the issuance of the NRC license to the Applicant. Cumulative impacts to ground-water quantity in the Lance and Fox Hills Formation, therefore, would be SMALL. The proposed Ross Project would have a SMALL incremental impact on the SMALL cumulative impacts to ground-water quantity in the ground water cumulative-impacts study area.

<u>Ground-Water Quality</u>

Impacts from previous uranium recovery at Nubeth are part of cumulative impacts to the area. Past impacts can be evaluated by comparing Nubeth's pre-operational baseline water-quality data to Nubeth's post-restoration data as summarized in Table 5.4 (Nuclear Dynamics, 1980; ND Resources, 1982) and to Strata's pre-licensing baseline data as described in Section 3.5. The data in Table 5.4 show that aquifer restoration at Nubeth returned the TDS to levels below pre-licensing conditions except for the injection well No. 20X, which also contained levels of radiological parameters above pre-operational baseline values at the close of restoration. Of the seven non-injection wells in the ore zone, three were restored to pre-operational values for both gross alpha and radium-226. Uranium concentrations after restoration exceeded pre-operational baseline in all of the ore-zone wells except for No. 5X. The well monitoring in the shallow-monitoring (SM) zone (No. 7X) did not show excursions of TDS and uranium. The pre-operational baseline and post-restoration radium-226 values in No. 7X were equivalent within the analytical error of the measurement. The gross-alpha measurement of 180 pCi/L [6.7 Bq/L] in well No. 7X for 4/1980 in Table 5.4 shows excursion of radioactivity into the aquifer above the ore zone. However, gross-alpha measurements in well No. 7X during the 1979 restoration period were much lower than 180 pCi/L [6.7 Bq/L], ranging from 1.4 – 4.7 pCi/L [0.1 – 0.2 Bq/L] (Nuclear Dynamics, 1980).

Table 5.4
Comparison of Baseline and Post-Restoration Water Quality at Nubeth

Well in Zone	Well Use	Sample Date	TDS (mg/L)	Gross Alpha (pCi/L)	Radium-226 (pCi/L)	Uranium (mg/L)
3X in OZ	Buffer	Baseline 4/1978	1680	290	73	0.071
		Restoration 10/1981	1500	130	22	0.24
4X in OZ	Buffer	Baseline 4/1978	1670	180	16	0.08
		Restoration 10/1981	1510	180	26	0.22
5X in OZ	Monitoring	Baseline 4/1978	1600	157	0.3	0.1
		Restoration 4/1980	1550	37	0.5	0.035
6X in OZ	Monitoring	Baseline 4/1978	1740	128	0.6	0.075
		Restoration 4/1980	1650	66	0.1	0.095
7X in SM	Observation	Baseline 4/1978	1530	<3*	0.5	0.008
		Restoration 4/1980	1400	180	0.6	<0.001
11X in OZ	Monitoring	Baseline 4/1978	1750	112	1.4	0.079
		Restoration 4/1980	1730	116	1	0.082
12X in OZ	Monitoring	Baseline 4/1978	1620	72	2.3	0.073
		Restoration 4/1980	1520	111	1.6	0.076
19X in OZ	Recovery	Baseline 4/1978	1680	310	97	0.3
		Restoration 10/1981	1510	300	31	0.48
20X in OZ	Injection	Baseline 4/1978	1270	7.7	0.6	0.006
		Restoration 10/1981	1520	85	20	0.068

Source: Nuclear Dynamics, 1980; ND Resources, 1982.
Note:
* "<" = "Less than," where the value following the "<" is the detection limit.

Evaluation of the restoration conditions in Nubeth's wells provides a short-term assessment of past impacts. The longer-term impacts from Nubeth are determined by a comparison of Nubeth's pre-operational baseline water-quality data with Strata's pre-licensing baseline data as described in SEIS Section 3.5.3. The data presented in Table 3.7 in SEIS Section 3.5.3 suggest that the current water quality in the ore zone and the SM zone are the same as Nubeth's pre-operational baseline values. Thus, the aquifers are not currently impacted by past uranium-recovery activities by Nubeth.

As described in SEIS Section 4.5.1, water quality at the Ross Project could be impacted by excursions from the ore zone into surrounding aquifers. The lixiviant injected into the ore zone causes metals such as uranium, vanadium, arsenic, selenium, and molybdenum as well as other parameters such as radium to dissolve into the ground water. Despite the design of the wellfields and the pumping methods, which are to contain the uranium-recovery process within the exempted aquifer, short-term impacts from excursions do occur. As described in SEIS Sections 2.1.1 and 4.5.1, a network of monitoring wells around the perimeter of each wellfield would provide the capability for early detection, control, and reversal of such excursions; ground-water restoration would return the exempted aquifer to levels that would be established in the NRC license. As described in SEIS Section 4.5.1, therefore, the potential impacts to the ground-water quality from the Ross Project would be SMALL.

The TDS of ground water in the Lance and Fox Hills aquifers generally increases with greater well depth and distance into the Powder River Basin (i.e. down-gradient of the Lance District) (Langford, 1964). Also, NRC license conditions would require the Applicant to recover any excursions into aquifers surrounding the ore zone. Thus, in the unlikely event that increased concentrations of metals mobilized by the lixiviant at the Ross Project migrate down-gradient, the geochemical conditions of the ore-zone aquifer outside the exempted zone would promote lower dissolved metal concentrations (i.e., would cause the dissolved metals to precipitate out). As the dissolved metals enter portions of the aquifer that had not been subjected to the oxidizing lixiviant, the naturally occurring oxygen-deficient conditions would cause chemical reactions that would precipitate the dissolved metals as minerals into the rock of the impacted aquifer. Thus, cumulative impacts to ground-water quality would be SMALL.

Thus, the incremental impacts of the proposed Ross Project in terms of both ground-water quantity and quality would be SMALL when added to the SMALL ground-water quantity and quality cumulative impacts in the ground-water cumulative-impacts study area.

5.8 Ecology

The geographic area considered in the analysis of cumulative impacts is the entire Powder River Basin (the “ecology cumulative-impacts study area”) because grassland and sagebrush shrubland habitats are important features of the Basin’s entire landscape, and these habitats occur on the Ross Project area as well. The Powder River Basin includes approximately 1,801,401 ha [4,451,360 ac] of land (BLM, 2009e). Approximately 222,568 acres, or 5%, of the Powder River Basin land area has been disturbed by past development activities. Of this amount, one-half of the disturbed area has been reclaimed (BLM, 2009e).

The timeframe for the ecological-resource cumulative-impacts analysis is from 2013 to 2032. This time frame was chosen to allow impacts to ecology of the Ross Project area and its vicinity to mature. It would take some time (the NRC has assumed five years) for the flora and fauna to fully recover after site restoration.

5.8.1 Terrestrial Ecology

Activities occurring in the vicinity of the Ross Project include livestock and wildlife grazing, agricultural production, and mineral exploration. These activities take place over a larger area of the Powder River Basin as well. As discussed in SEIS Section 4.6, potential impacts to ecological resources, both flora and fauna, include reduction in wildlife habitat and forage productivity; modification of existing vegetative communities; and potential spread of invasive species and noxious weed populations. Impacts to wildlife could involve loss, alteration, and incremental habitat fragmentation; displacement of and stresses on wildlife; and direct and indirect mortalities.

5.8.1.1 Vegetation

Vegetation at the Ross Project area is primarily sagebrush shrubland and upland grasslands, which are typical of the Powder River Basin. As discussed in Section 4.6, the impacts to vegetation at the Ross Project area would be SMALL.

There are no operating or licensed ISR facilities within 83 km [50 mi] of the Ross Project area, although there is a potential for development of satellite areas as part of the Applicant's development of the entire Lance District. There are also four potential ISR uranium-recovery projects in the very early stages of development as described earlier (i.e., Aladdin, Elkhorn, Hauber and Altzada). To assess the projected extent of vegetation that would be affected by the development of these prospects, the NRC staff assumed that approximately the same area affected by the Ross Project (113 ha [280 ac]) would also be affected by these other ISR projects. With this assumption, the four Lance District areas and the four other independent ISR projects would impact approximately 904 ha [2,240 ac], for a total potential vegetation impact from ISR projects in the study area of 1,017 ha [2,520 ac]. This accounts for approximately 0.05 percent of the total ecology cumulative-impacts study area. Therefore, these ISR projects would have a SMALL impact on vegetation.

Other mineral development activities described in Section 5.2, including coal-, oil-, and gas-recovery developments, occur within the Powder River Basin. Currently, 53, 680 ha [132,645 ac] of land is disturbed by these activities (BLM, 2009e). Reclamation would be required for these activities within the Powder River Basin in their respective permits. It is estimated that all but approximately 0.8 percent of the disturbed vegetation would be reclaimed (BLM, 2009e). The remaining areas would be associated with permanent infrastructure components. Therefore, the impact to vegetation within the Powder River Basin due to the identified activities would also be SMALL.

5.8.1.2 Wildlife

Loss and degradation of native sagebrush shrubland habitats has affected much of this ecosystem type as well as sagebrush-obligate species including the Greater sage-grouse. Most of the sagebrush shrublands in the Powder River Basin have already been significantly changed by land uses such as livestock grazing, agriculture, or resource extraction. These uses can influence habitats either directly or indirectly; for example, an indirect effect would be the alteration of the natural regime, which could change the frequency of land-clearing fires (Naugle, et al., 2009). For example, the long-term viability of the Greater sage-grouse continues to be at risk because of population declines related to habitat loss and degradation. Because of its spatial extent, oil- and gas-resource development is regarded as playing a major role in the decline of this species in the eastern portion of its range (Becker, et al., 2009). Therefore, there are currently MODERATE cumulative impacts to the Greater sage-grouse. As of NRC's cumulative-impacts analysis, the USFWS has designated the Greater sage-grouse as a "candidate species" under the *Endangered Species Act* (ESA) and would consider the bird on an annual basis for listing as a threatened or endangered species.

However, the impact to sagebrush shrubland communities at the proposed Ross Project would be SMALL because only 113 ha [280 ac], 16 percent of the total Project area, would be disturbed. Additionally, only 21 percent of the Ross Project area consists of sagebrush shrubland habitat. Most of the habitat disturbance would consist of scattered drilling sites for wells; these would not result in large expanses of habitat being dramatically transformed from its original character as in other surface-mining operations; no substantial long-term impact would be expected. No leks or wintering areas have been identified on the Ross Project area, and the area is not located within a designated core area for the Greater sage-grouse.

In addition, potential impacts (e.g., habitat loss, habitat fragmentation, and noise disturbance) would also likely occur at mines and oil and gas facilities throughout the geographic ecological-resource cumulative-impacts area, and would potentially impact other localized wildlife populations. The impacts to other species would be similar; therefore, impacts from the other Lance District and other ISR projects would be SMALL. Other past, present, and reasonably foreseeable future actions discussed in the Powder River Basin could result in the disturbance of tens of thousands of acres. However, site-reclamation permit requirements and BMPs would mitigate these impacts, and it is expected that the cumulative impacts on terrestrial ecological resources would be SMALL in the Powder River Basin. Cumulative impacts to the Greater sage-grouse would continue to be MODERATE.

5.8.2 Aquatic Ecology

Three amphibians and five reptiles designated as Wyoming Species of Concern (WSOC) have been observed on the Ross Project area. However, because aquatic areas would be avoided during construction and operation, the proposed Ross Project would have a SMALL impact on aquatic resources. Similarly, due to the amount of surface disturbance in the Powder River Basin (5 percent), and the mitigation requirements associated with the regulatory permits and licenses, the cumulative impacts on aquatic ecology anticipated from the other past, present, and reasonably foreseeable future actions within the Powder River Basin would be SMALL (BLM, 2009e).

5.8.3 Protected Species

No Federal- or State-listed protected plant species or designated critical habitats occur within the proposed Ross Project area. With regard to protected species, the Ross Project has the potential to impact 12 avian species known to be present on the Ross Project area (see SEIS Section 4.6). Impacts would be SMALL, however, due to the limited footprint of the actual buildings and other structures across the entire Ross Project area.

There are Federally listed protected species within the Powder River Basin, including the Ute ladies'-tresses orchid, the Preble's Meadow Jumping Mouse, the Boreal Toad and the Mountain Plover (BLM, 2003). Additionally, the Bald Eagle is located throughout the Powder River Basin. On the lists of sensitive species maintained by the BLM, WGFD, and the USFS, there are 3 plants, 3 amphibians, 1 snake, 10 fish, 25 birds, and 8 mammals that are known to occur within the Powder River Basin. For the majority of these species, the BLM determined that there may be an affect due to development (BLM, 2003); however, considering the location of development activities compared with the occurrence of many of these species, and with the permit requirements that are in place, the impacts to all but one species would be SMALL.

Potential impacts to the greater sage grouse were identified by the BLM to be of particular concern.

The USFWS has designated the Greater sage grouse as a “candidate species” under the ESA, and will consider the bird on an annual basis for listing as a threatened or endangered species. Within the Power River Basin, potential impacts were identified due to loss of habitat and connectivity, construction of disposal ponds for produced waters generated during oil and gas activities, and disturbance related to increased vehicular traffic (BLM, 2003). Because of these factors, the BLM concluded that the cumulative impacts would likely result in a downward trend for the sage grouse population, and may lead to its federal listing.

Therefore, the NRC staff determined that the cumulative impact on protected species within the ecological resources study area resulting from all past, present, and reasonably foreseeable future actions is SMALL to MODERATE.

Thus, the proposed Ross Project would have a SMALL incremental impact when added to the SMALL to MODERATE cumulative impacts on the ecology of the Powder River Basin.

5.9 Air Quality

The geographic area for the cumulative impacts analysis was based on the NRC staff’s consideration of other regional air-modeling studies that address larger-scale emissions sources applicable to oil and gas activities as well as a general understanding of the effect of source-emission strength on the spatial extent and magnitude of downwind air impacts (i.e., larger plumes transport air emissions longer distances downwind before diminishing to insignificant levels). The “air-quality cumulative impacts study area” was therefore defined for air-quality emissions as a circular area formed by an 80-km [50-mi] radius around the Ross Project area. However, significant air-pollution contributors and prevention of significant deterioration (PSD) sensitive areas up to approximately160 km [100 mi] were included, as appropriate, in this analysis. As shown on Figure 5.1, an 80-km [50-mile] radius area encompasses the northeast corner of Wyoming, including the city of Gillette and numerous small towns, and extends into South Dakota and Montana.

Any immediate air-quality impacts of the Ross Project would dissipate quickly once wellfield closure and facility decommissioning is complete and as vegetation is re-established in the areas where there was soil disturbance. The generally windy conditions present at the Ross Project readily disperse airborne pollutants and suspended particulates under the influence of gravity fall out of suspension. As described in Section 5.3.2, the timeframe considered in this assessment of air-quality cumulative impacts begins in 2013, when the NRC could issue a license for the Ross Project, and ends in 2027 when the license would be terminated at the end of the Ross Project’s decommissioning phase. After license termination, there would be no impacts on air quality by the Ross Project.

As noted in SEIS Section 4.7, the potential impacts to air quality from the Ross Project would be SMALL during each phase of the Project. Air-quality impacts primarily involve combustion-engine emissions from both the equipment that would be used predominantly during the construction and decommissioning phases of the Ross Project as well as the combustion-engine emissions associated with the commute of Project workers and Project deliveries and shipments. In addition, there would be measurable fugitive-dust emissions from roads traveled by vehicles used for commuting, deliveries, and shipments to and from the Ross Project facility, as well as from the land-disturbing activities during, especially, the construction and decommissioning phases.

Very small emissions are possible from processes at the CPP and/or the storage of waste liquids in the surface impoundments at the Ross Project facility. These could include minor chemical emissions during tank and vessel refilling, chemical delivery, or waste shipments. Windblown emissions from the surface impoundments are also possible. However, BMPs, SOPs, and other air-quality-related management plans, such as monitoring plans, that the Applicant would adhere to, would help mitigate air emissions and air quality impacts. Other facility-design attributes, such as exhaust-point filters, would help to reduce these potential air-quality impacts.

The Ross Project could contribute to air-quality cumulative impacts when its environmental impacts overlap with those of other present or reasonably foreseeable future actions. As described in SEIS Section 5.2, other past, present, and future actions in the air-quality cumulative-impacts study area could include additional ISR uranium-recovery projects, both those by the Applicant in the Lance District and four other planned ISR projects in the study area; coal, bentonite, and rare-earth element mining; oil and gas production; electricity generation by a wind farm; and the current uses of cattle and sheep grazing. However, air-quality impacts from past operations in the study area have been resolved as demonstrated by the discussion in SEIS Section 3.7.

Three of the most important metrics in the estimate of the cumulative impacts of combustion-engine and fugitive-dust emissions is the amount of soil that is disturbed during a project's construction, road installation, and wellfield drilling as well as the types of roads used to access the project (e.g., gravel roads), their maintenance, and the number of vehicles on the roads (see SEIS Section 4.7). In general, undisturbed surfaces produce much less dust than disturbed surfaces, because the undisturbed surfaces usually require considerably higher wind speeds to pick up and suspend particles that then become a significant emission source (Countess, 2001). Also in general, fugitive dusts are usually generated by ground-level activities.

The Ross Project would ultimately disturb 113 ha [280 ac] of soil; there are, however, no other existing ISR projects within the air-quality cumulative-impacts study area that could, at the present time, generate impacts to air quality because of the disturbance of native soils. Studies have been performed to better understand the characteristics of the windblown fugitive dust and mechanically re-suspended road dust that contribute to regional haze (i.e., visible air pollutants such as fugitive dust). These studies are summarized in SEIS Section 4.7.1.1 and indicate that the majority of fugitive-dust-related air-quality impacts caused by the Ross Project would not be expected to extend beyond the 80-km [50-mi] radius around the proposed Ross Project area during its entire lifecycle.

However, as described in SEIS Section 5.2, four satellite areas within the Lance District could be developed for uranium recovery by the Applicant (Strata, 2012a). The NRC staff has made the assumption that each of these satellite areas would involve the same amount of soil disturbance as the Ross Project. (This is a conservative approach, as the satellite areas would not include a CPP and surface impoundments.) Thus, the satellite areas would result in approximately 450 ha [1,120 ac] of soil disturbance. It was further assumed that any air-quality impacts of these satellite areas would be mitigated with the same measures identified in SEIS Section 4.7 for the Ross Project itself. These dust-control measures would include the Applicant minimizing the area of soil that would be disturbed at any one time, spraying water to suppress dust, and promptly revegetating disturbed areas. Further, the Applicant's enforcement of speed limits, treatment roads to minimize dust, and restriction of equipment-operation hours would further mitigate fugitive-dust impacts.

Although no other nuclear-fuel-cycle or ISR projects are currently operated within 80 km [50 mi] of the Ross Project, within the 80-km [50-mi] radius of the Ross Project area there are four other, potential uranium-recovery projects in the early planning stages as noted in Section 5.2. These include the Aladdin Project (7,100 ha [17,550 ac]), the Elkhorn Project (2,110 ha [5,215 ac]), the Hauber Project (469 ha [1,160 ac]), and the Alzada Project (10,000 ha [25,000 ac]).

It has been assumed that these projects would be developed similarly to the Ross Project and that 16 percent of the total area of each would be disturbed during these projects' lifecycles. This would result in approximately 3,150 ha (7,840 ac) of soil disturbance. Because ISR uranium-recovery commonly employs a phased approach to well drilling and wellfield construction, and because the four facilities would not begin construction simultaneously (as each must go through an average two-year licensing process), the degree of overlap for activities associated with these four ISR projects would likely occur predominantly during the wellfield-drilling phase, not the plant construction phases. Thus, the surface disturbances likely would not occur simultaneously and would not be additive. Once fugitive dust was suspended in the air, the dust would settle out within the distances described earlier (not exceeding 80 km [50 mi]. In this assessment of air-quality cumulative impacts, it has been further assumed that combustion-engine and fugitive-dust emissions as well as any processing plant emissions would be managed and mitigated in a manner similar to the Ross Project. Therefore, the relative contribution of reasonably foreseeable future ISR projects to any regional air-quality impacts would be SMALL.

As shown on Figure 5.1, 9 coal mines are located within 80 km [50 mi] of the Ross Project area, southwest of the Project (Strata, 2012a). The straight-line distances to the nine active coal mines within 80 km [50 mi] range from 45 – 72 km [28 – 45 mi]. Five surface coal mines are within approximately 48 km [30 mi] of the proposed Ross Project. This distance is sufficient to ensure that any fugitive dusts that would be generated at either the Ross Project or the coal mines would not be additive and that the particulates, whether mechanically suspended or windblown, would settle out prior to traveling those distances.

As noted in SEIS Section 3.7.3, no violations of the ozone standard have occurred in the area. The levels reported by the nearby air-quality monitoring stations described earlier, however, are close to the respective ozone standard (see Table 3.17 in SEIS Section 4.7.1). Reasonably foreseeable future actions, if conducted concurrently with the Ross Project, could result in occasional exceedances of the ozone standard because of the cumulative number of vehicles associated with all of the activities. However, because of the distance to these mines and the pollutant mixing afforded by the winds in Wyoming, air-quality impacts related to ozone would also be SMALL.

This conclusion is consistent with a previous evaluation by BLM of potential air-quality impacts from future coal and CBM mining, and oil and gas production in the Powder River Basin (BLM, 2003; BLM, 2006; BLM, 2009b; BLM, 2009e; BLM, 2010; ENSR, 2006; BLM, 2009e). This recent BLM cumulative-impacts analysis of air quality in the Powder River Basin was conducted to support the development of increased coal production (BLM, 2009e). Emissions data were acquired for the base year of 2004 for NO_2, SO_2, $PM_{2.5}$, and PM_{10}; these were then modeled to 2020. The estimated impacts of the modeled emissions indicated that air-pollutant concentrations were compliant with (i.e., below) the National Ambient Air Quality Standards (NAAQS), except for the 2020 estimates where short-term and annual $PM_{2.5}$ and PM_{10} standards were exceeded in localized areas. Therefore, although future coal-mine expansion and development of other projects could result in some increase in emissions in the Powder River Basin and downwind areas during the cumulative-impacts study's general timeframe, such impacts would be SMALL.

Ten current bentonite mining operations are within 80 km [50 mi] of the Ross Project area. The straight-line distances to the ten active bentonite mines from the Ross Project range from 5 – 88 km [3 – 55 mi]. The Oshoto bentonite mine is approximately 5 km [3 mi] from the Ross Project area; the next closest bentonite mine is approximately 56 km [35 mi] distant (Strata, 2012a). Surface mining of bentonite can result in significant removal and disturbance of soils during operation, resulting in both combustion-engine and fugitive-dust emissions. However, bentonite mines must apply the same BMPs and other air-quality-management tools as would the Ross Project, including spraying exposed soils to ensure that fugitive particulates are not generated. Currently, bentonite mining has a SMALL impact on air quality.

Finally, numerous oil fields are located within 80 km [50 mi] of the Ross Project area. In general, future development of these resources would include well installation and operation activities which would cause combustion-engine emissions and some soil disturbance, generating fugitive dust. However, it has been assumed that combustion-engine and fugitive-dust emissions would be managed and mitigated in a manner similar to the Ross Project. Both the potential rare-earth metals extraction and wind-power projects have also been assumed to be required to manage and minimize each project's respective soil disturbance and combustion emissions during construction and operation. Thus, the air-quality cumulative impacts related to these present or reasonably foreseeable future projects would be SMALL.

Because nonradiological emissions associated with uranium recovery would be very low, as would those from existing and reasonably foreseeable future actions in the region, the NRC staff has concluded the incremental air-quality impacts of the Ross Project would be a SMALL contribution to the SMALL cumulative impacts to air quality resulting from past, present, and future actions.

5.10 Global Climate Change and Greenhouse-Gas Emissions

5.10.1 Global Climate Change

While there is general agreement in the scientific community that some change in climate is occurring, considerable uncertainty remains in the magnitude and direction of some of these changes, especially during the prediction of trends in a specific geographic location. To predict the effect on climate change of the proposed Ross Project (and vice-versa), temperature and precipitation data for Wyoming were evaluated. Data have been collected over the period of 1895 – 2010. On average, the temperature in Wyoming has increased approximately 0.09 °C [0.16°F] per decade during this time period (NCDC, 2011a). In its report, the U.S. Global Change Research Team (USGCRT) indicated that the temperatures in the past 15 years have risen faster (i.e., 0.83°C [1.5 °F] for the Great Plains), most of which is attributed to warmer winters (GCRP, 2009). The projected change in temperature over the period from 2000 – 2020, which encompasses the period that the Ross Project would be licensed and operated, ranges from a decrease of approximately 0.28°C [0.5 °F] to an increase of approximately 1.1 °C [2 °F] (GCRP, 2009).

For the same period (i.e., 1895 – 2010), a slight downward trend in precipitation (0.30 cm [0.12 in] per decade) has been measured (NCDC, 2011b). Nevertheless, the USGCRT has predicted that the Great Plains region would receive increased precipitation in future decades. Most of the precipitation is expected to fall in the colder months (i.e., winter and spring), and the summer and fall are predicted to become drier. In addition, with the colder months expected to warm over the next several decades, more precipitation would fall in liquid form, resulting in less snow pack in the higher elevations (GCRP, 2009).

The small predicted increases in temperatures and precipitation over the next decade would have no effect on any of the phases of the Ross Project. Because one of the most significant activities at the Ross Project would be below ground, the effects of the surficial and atmospheric environments are not expected to impact significantly uranium recovery. There could be an increase in recharge to aquifers underlying the Ross Project area in future years, which would result from the predicted increased precipitation (i.e., higher precipitation would consequently increase infiltration into the ground water regime). This could affect the Ross Project by increasing the volume of ground water in the ore-zone and improving the effectiveness of the aquifer-restoration process. Similarly, while potential changes to the Ross Project area environment and its resources, such as ecology, are plausible, the small magnitude of the predicted climate change during the period when the uranium recovery would be conducted is not sufficient to alter the environmental conditions at the Ross Project area in a manner that would significantly change the environmental impacts from those that have been evaluated in this SEIS. Based on the above analysis, the proposed Ross Project's incremental impact to predicted climate change is SMALL.

5.10.2 Greenhouse-Gas Emissions

The evaluation of cumulative impacts of greenhouse-gas (GHG) emissions requires the use of a global-climate model. A comparison of annual carbon dioxide emissions by source is included as Table 5.5. A U.S. Global Change Research Program (GCRP) report provided a synthesis of the results of numerous climate-modeling studies (GCRP, 2009). NRC staff has concluded that the cumulative impacts of GHG emissions around the world, as presented in the GCRP report, are an appropriate basis for its evaluation of cumulative impacts. Based upon the impacts identified in the GCRP report, the national and worldwide cumulative impacts of GHG emissions are noticeable, but they are not destabilizing (refer to SEIS Section 5.3 which defines the impact magnitudes that the NRC uses). Consequently, a meaningful approach to address the cumulative impacts of GHG emissions, including carbon dioxide, is to recognize that such emissions contribute to climate change and that the carbon footprint is a relevant factor in the evaluation of potential impacts of alternatives.

Table 5.5
Comparison of Annual Mass of Carbon-Dioxide Emissions by Source

Source	Annual CO_2 Emissions (tonnes [T])	Percent of World Emissions	Percent of U.S. Emissions
Global Emissions (EPA, 2009)	28,000,000,000 [30,884,000,000]	100%	500%
United States (EPA, 2009)	6,000,000,000 [6,618,000,000]	21%	100%
Current/Proposed ISR Facilities	7,380 [8,140]	0.000026%	0.00012%
Average U.S. Passenger Vehicles (FHWA, 2006)	4.5 [5]	Negligible	Negligible
Estimated Proposed Ross Project (Strata, 2011c)	11,872 [13,087]	0.000042%	0.0002%

Note: t = Tonnes, or Metric tons.
T = Short tons, or U.S. tons.

The Center for Climate Strategies (CCS) prepared a report for the WDEQ that provides an inventory and forecast of Wyoming's GHG emissions (CCS, 2007). These emissions data were based on projections from electricity generation, fuel use, and other GHG-emitting activities. Emissions are reported as carbon-dioxide equivalents (CO_2e); this conversion renders all of the various gases emitted (i.e., methane or nitrous oxides) during an operation or activity into an equivalent GHG effect compared to carbon dioxide. Gross CO_2e emissions in 2005 for Wyoming were 56 million t [62 million T]; these account for less than 1 percent (i.e., 0.8 percent) of the total U.S. gross GHG emissions. This total is reduced to 36 million t [40 million T] CO_2e as a result of annual sequestration (i.e., removal) due to forestry and other land uses (CCS, 2007).

Wyoming has a higher per-capita emission rate than the national average (i.e., greater than 4 times the national average), due primarily to the State's fossil-fuel-production industry, industries that consume great amounts of fossil fuels, a large agricultural industry, great distances between Wyoming cities, and a small population (EPA, 2008). The report shows that the Wyoming GHG emissions would continue to grow as demand for electricity is projected to increase, followed by emissions associated with transportation. It is estimated that Wyoming gross GHG emissions will be 69 million t [76 million T] by 2020 (EPA, 2008).

According to the Wyoming Oil and Gas Conservation Commission (WOGCC), the State of Wyoming contains over 33,000 active gas and oil wells, 45 operational gas-processing plants, 5 oil refineries, and over 14,484 km [9,000 mi] of gas pipelines (CCS, 2007). Because there is no regulatory requirement to track carbon dioxide or methane emissions, there is a high degree of uncertainty associated with the estimated Wyoming GHG emissions from the oil and gas industry. However, the CCS estimated that approximately 13.5 million t [14.9 million T] of CO_2e was emitted by fossil-fuel industries (CCS, 2007). Of this amount, 80 percent was due to the natural-gas industry. This amount is expected to grow an additional 8 to 10 percent in the next decade (CCS, 2007). No data currently exists for the non-fossil fuel industries, including the uranium-recovery industry.

In response to current concerns related to GHG emissions, the Applicant evaluated carbon-dioxide emissions for the lifecycle of the Ross Project and then compared them with other forms of resource extraction. Annual and cumulative carbon-dioxide emissions from the Ross Project during the construction and decommissioning phases were estimated by the Applicant during the air-permitting process for the WDEQ (Strata, 2011c). Combustion-engine exhaust calculations performed for the Ross Project were based upon a combination of Project-specific and representative information appropriate to support a conservative emissions screening analysis. The primary source of carbon-dioxide emissions at the Ross Project would result from combustion-engine emissions from construction equipment, including drill rigs (see Table 5.6). The GHG inventory was calculated for the maximum yellowcake production rate of 1,360 t/yr [1,500 T/yr]. Construction equipment is used most frequently during initial facility construction and wellfield installation, but also later during the decommissioning phase to demolish buildings, dismantle equipment, and reclaim the land.

Table 5.6
Maximum Annual Greenhouse-Gas Emissions
(CO_2 in t [T])

Activity	Carbon Dioxide (t [T])
Uranyl Tricarbonate Breakdown	640 [705]
Sodium Bicarbonate in Eluate	776 [855]
Product Drying	871 [960]
Space Heaters	1,049 [1,156]
Diesel Powered Equipment	8,433 [9,296]
Diesel Generators	104 [115]
TOTAL	11,872 [13,087]

Source: Strata, 2011c.

The Applicant found that minor amounts of methane and nitrous oxides, both of which are considered GHG, would be emitted during natural-gas combustion. The GHG potential or $C0_2e$ of these emissions is a fraction of one percent of the carbon-dioxide emissions, and they were therefore omitted from the calculations. The maximum GHG emissions per year coincide with the year where some wellfield installation, facility and wellfield operation, and aquifer restoration would occur concurrently (i.e., Year 4).

As described above, the total gross amount of GHGs produced in Wyoming in 2005 was 56 million t [61.7 million T], without the reducing effects of sequestration (EPA, 2008). If the 36 million t [39.7 million T] of GHGs sequestration is taken into account (EPA, 2008), the net total of GHGs produced annually in Wyoming is 20 million t [22 million T]. The Ross Project would conservatively produce a maximum annual GHG total of 11,872 t [13,087 T] (as carbon dioxide). This figure equates to approximately 0.06 percent of the net total GHGs produced in Wyoming in 2005. If there has been an increase in GHG emissions, or a decrease in sequestration since 2005, the effect of the Ross Project would be even less.

The Applicant's use of BMPs and other mitigation measures could minimize the emission of GHGs at the Ross Project. These mitigation measures could include, but are not limited to, the Applicant:

- Using fossil-fuel vehicles that meet latest emission standards.
- Ensuring that diesel-powered construction equipment and drill rigs are properly tuned and maintained.
- Using low-sulfur diesel fuel.
- Using newer, cleaner-running equipment.
- Avoiding equipment idling or equipment running unnecessarily.
- Minimizing the number of trips to drilling pads and wells.

Therefore, the potential impact of GHGs from the Ross Project would be SMALL and the cumulative impacts of GHG within the cumulative impacts study area would be SMALL.

5.11 Noise

Cumulative noise impacts were assessed within a rectangular area, a 300-m [1,000-ft] distance from all points of the Lance District, so as to include the potential development by the Applicant of satellite areas within the Lance District (the "noise cumulative impacts study area") (see SEIS Section 5.2). Although some noises would be detectable beyond the Lance District, this distance was considered appropriate because noise dissipates a short distance from the source.

As described in SEIS Section 5.3.2, the timeframe considered in the assessment of potential noise cumulative impacts begins in 2013 and ends in 2027. All Ross Project-related noise of any type would cease at the end of the decommissioning phase. There would be no more activities taking place at the Project area to generate noise, nor would there be any further worker commutes to and from the Project area, supply deliveries to the area, and yellowcake shipments from the area.

As discussed in SEIS Section 4.8, the potential impacts because of noise at the Ross Project result from both activities taking place at the Project itself as well as automobiles and trucks coming and going from the Project area. The noise generated at the Ross Project area would be the greatest during its construction phase and second greatest during the decommissioning phase. Vehicular noise would be generated during all phases, however, as workers commute; as supplies, materials, and uranium-loaded resins are delivered to the Project; and as yellowcake and wastes are taken away from the Project. All of these sources of noise would generate SMALL to MODERATE impacts during the lifecycle of the Ross Project.

As shown in Figure 2.6 in SEIS Section 2.1.1, the potential development of the Lance District would occur in significantly overlapping phases. Each of the phases (i.e., construction, operation, aquifer restoration, and decommissioning) at each of the satellite areas would produce the same noise as discussed in SEIS Section 4.8.1 for each phase of the Ross Project. At the Ross Project itself, the sources of noise are primarily associated with the operation of construction and drilling equipment during facility construction and wellfield installation as well as vehicular noise. In general, the noise generated during construction would occur during only the Ross Project’s construction, not at any of the satellite areas because the satellite areas would be predominantly only additional wellfields. However, the Applicant has indicated it expects to construct an IX facility at the Barber satellite area to treat pregnant lixiviant by IX. Thus, some construction noise can be expected there while that smaller facility is built.

As Figure 2.6 in SEIS Section 2.1.1 shows, wellfield installation would begin at the very start of the Ross Project and continue through at least 2021. During this time, other wellfields would begin to enter the aquifer-restoration phase and even decommissioning. Nonetheless, this cumulative-impacts analysis has assumed that the noise generated within the Lance District would be the same as the construction phase throughout the Project’s lifecycle, including all satellite areas. Thus, this noise—the maximum of which would occur during the CPP’s and surface impoundments’ construction during the same time the first wellfields are being installed—would be SMALL.

Based upon a construction phase where 400 passenger vehicles and 24 heavy truck trips per day would be the single highest traffic volume anticipated for the four phases of the Ross Project, the maximum estimated impacts of vehicular noise would not exceed the noise evaluated in SEIS Section 4.8, and thus these impacts would be short-term and SMALL to MODERATE (for the nearest residences). The transportation of process chemicals and supplies to the Ross Project, and yellowcake and waste shipments from the Ross Project, were predicated on the maximum yellowcake production rate of 1.4 million kg/yr [3 million lb/yr], which would include the truck delivery of uranium-loaded IX resins from the Barber satellite area to the Ross Project’s CPP. With respect to noise generated by vehicular traffic as a result of the Lance District’s development, there would be some increase in noise because of the additional uranium-loaded resins produced at the Barber satellite area being trucked to the Ross Project CPP for further treatment and production of yellowcake. As well, the anticipated maximum workforce of 60 Project-operation workers at the Ross Project was predicated on this maximum yellowcake production rate. That is, the workforce would not increase because of the additional Lance District satellite areas, were they to be developed (Strata, 2012). Thus, vehicular noise would not increase with the additional Lance District satellite areas, because the number of vehicles has already been considered in SEIS Section 4.8.

There are no past, present, or additional reasonably foreseeable future actions within the noise cumulative-impacts study area than those in the Lance District itself; all of the ISR facilities in the preplanning stage near the Ross Project are over ten miles away from the Project area. Similarly, all other past, present, and future actions are greater than 300 m [1,000 ft] away, and no cumulative noise impacts would occur. This cumulative-impacts analysis included a search for any planned oil- and gas-extraction projects that would take place in the Lance District; however, none were identified. Because the Applicant is also unaware of any such plans, this analysis did not include any noise related to future oil- and gas-recovery wells in the Lance District. Thus, construction noise cumulative impacts would be SMALL.

Some of the present and reasonably foreseeable future actions that could be constructed near the Ross Project area as described in SEIS Section 5.2, however, could produce noise cumulative impacts related to vehicular traffic. For example, the primary access route to and from the Ross Project and the Lance District would be along D Road (County Road [CR] 68) for 18.3 miles, then the New Haven Road (CR 164) for 3.0 miles to the appropriate access roads onto the Ross Project area itself (see Figure 2.1 in SEIS Section 2) (Strata, 2011a). Virtually all traffic associated with the Ross Project would use this access route (Strata, 2012a). Of the present and potential projects identified during the noise cumulative-impacts analysis, the only potential projects that would share the route on D and New Haven Roads would be the Elkhorn and Hauber ISR projects. Because of the uncertainty of uranium recovery and processing methods that would be proposed, no estimate of the number of employees or truck traffic is possible at this time (Strata, 2012). However, if it is assumed that the same workforce would be required for those two developments (as was assumed in the transportation cumulative-impact analysis in SEIS Section 5.5), then there would be SMALL to MODERATE cumulative impacts with regard to noise along D and New Haven Roads.

In addition, the existing bentonite mine just northeast of the Ross Project area would contribute to noise along some of the routes potentially taken by the Applicant's personnel at the Ross Project. Highway-legal trucks (as opposed to heavy mine-haul trucks) transport bentonite from the Oshoto Mine to a processing and packaging plant in Upton (see Figure 5.1). The transportation route between the Oshoto Mine and Upton includes portions of D and New Haven Roads, which are adjacent to the Ross Project area and the Lance District. The bentonite truck routes also include roads north and east of the Ross Project that would not be used by Ross Project-related traffic. The degree to which the increased traffic would contribute to potential cumulative noise impacts would depend on hiring and production at Oshoto. The daily Oshoto Mine traffic is estimated at eight commuter trips and ten truck trips. This traffic was already included in the analysis of both transportation and noise impacts in SEIS Sections 4.3 and 4.8 (see also Table 3.2 in SEIS Section 3.8). Thus, the noise associated with the present operation of the nearby bentonite mine has already been considered in the noise impacts found to be SMALL to MODERATE during the Ross Project's lifecycle.

All of the sources of noise described above would be short-term and dissipate quickly with distance. For noise levels typical of drilling and construction, including multiple simultaneous noise sources in close proximity, calculations show that at the residences nearest to the Ross Project, the average noise from equipment would be significantly less than 55 dBA based on the noise data collected by the Applicant (EPA, 1978; Strata, 2011a). Given the distance between potential and existing projects, the Ross Project and Lance District areas would only contribute SMALL incremental impacts. However, given the potential noise from increased traffic on local roads as a result of present and reasonably foreseeable future projects, there would be MODERATE noise cumulative impacts to the residents living nearest the roads traversed by traffic associated with these projects. These MODERATE impacts would continue insofar as the two potential ISR projects (Elkhorn and Hauber) use the primary access roads to the Ross Project.

5.12 Historical, Cultural, and Paleontological Resources

The assessment of cumulative impacts on historical, cultural, and paleontological resources has been geographically defined as the area of Area of Potential Effect (APE) that has been established through the Section 106 consultation process. The APE is discussed in Section 3.9. It includes the Ross Project area, the access roads to and from the area, and a buffer outside the proposed Ross Project's boundaries as well as the area established for potential effects to traditional cultural properties (TCPs). In relationship to other proposed undertakings with the potential to affect these resources, the regional cultural sub-area constituted by the headwaters of the Little Missouri River and the Cretaceous-era Lance Formation provide vectors for analysis of cumulative effects to the archaeological and paleontological record.

The cumulative-impacts analysis timeframe begins in 2013, when the Applicant would be issued a license by the NRC, and concludes in 2027, the estimated year the license would be terminated after the decommissioning and site restoration of the Ross Project.

The Class I and Class III cultural resource survey conducted for the Applicant at the Ross Project area in 2010 resulted in the identification of 24 new sites and 21 isolated resources. A previously recorded site, 48CK1603, which was not found during the survey in 2010, was identified and included in an updated report provided by Strata in 2011. 15 of the sites are recommended by the Applicant as eligible for the National Register of Historic Places (NRHP). The remaining sites were determined to be ineligible for listing (Ferguson, 2010). However, the NRC staff's evaluations to determine whether these properties are eligible for NRHP listing are ongoing. Also, sites of Tribal religious and cultural significance could potentially be identified during a TCP survey of the Ross Project area (see SEIS Section 1.7.3.2). At present, there is already some disturbance from past livestock grazing and agricultural activities as well as some encroachment due to road construction, but other effects from human activities are minimal. Erosion is currently causing some site damage as archeological and paleontological materials erode out of cut banks. In some portions of the APE where alluvium is present, some sites as yet unidentified likely remain protected by intact terraces, and they may be deeply buried.

Archaeological investigations for the Ross Project and other undertakings in the vicinity show that humans have occupied the area for at least 12,000 years (Ferguson, 2010). The Ross Project area is situated in a known culturally-sensitive area at the headwaters of the Little Missouri River, where there is potential for deeply buried archaeological materials that could provide information on earlier periods of regional culture. Ground disturbance during construction activities would be the greatest threat to archaeological sites. This includes the impacts of excavation as well as from construction of access roads. There is a risk of damaging Native American archaeological sites that may be eligible for the NRHP, depending on the depth and location of such ground disturbances.

Ground disturbances could also have an adverse impact on TCPs by damaging landforms or other organic relationships that create or enhance a TCP's setting. A TCP could also be damaged by compromising of the very qualities that make it significant to a community and help it to maintain and perpetuate cultural identity and values. Significant qualities could include integrity of visual setting, a sense of privacy, silence, and other factors that support the general ambiance of a natural setting.

The Project could also damage paleontological resources, as the APE is situated within the Late Cretaceous-age Lance Formation, which is known for its potential to contain a variety of fossil types. Paleontological remains in two of the prehistoric sites recorded during the Class I survey were brought to the site from elsewhere, but, as in the case of the potential for buried sites, paleontological materials of varying ages could be encountered wherever the Lance Formation is penetrated or otherwise disturbed.

To determine cumulative effects, other proposed projects in the nearby Powder River Basin were reviewed for activities that have the potential to impact historical, cultural, and paleontological resources. Other ongoing developments include activities related to energy development, including other potential ISR uranium-recovery projects, coal mines, and oil- and gas-recovery operations. The potential projects related to changing population demographics and public-service needs throughout the general vicinity include wind-power facilities; utility transmission and distribution lines; transportation infrastructure; reservoir development; agricultural activities; livestock grazing; and other economic endeavors. Activities related to all of these pursuits—in addition to natural effects, particularly erosion—have the potential to amplify the impacts of the Ross Project. These impacts taken cumulatively can lead to incremental damage to the archaeological and paleontological record by the elimination of potential data points from the cumulative record of the entire vicinity.

The Applicant expects to develop subsequent areas of the Lance District for uranium-recovery satellite operations (see Figure 2.2 in SEIS Section 2.1.1). No information on identified cultural resources is available for the Lance District; however, similarity in landscape and existing conditions make it likely that the impacts to historical, cultural, and paleontological resources would be similar to those resulting from Ross Project.

Cumulative-impacts analysis for the Moore Ranch project, which is the nearest operating ISR facility to the Ross Project, indicated that the potential impacts of its construction and operation would be small, because the Moore Ranch project is not expected to directly impact eligible archaeological sites when added to the moderate cumulative impacts to the resources from other past, present, and reasonably foreseeable future actions (NRC, 2010). The Nichols Ranch ISR facility, approximately the same distance from the Ross Project area as the Moore Ranch project, identified numerous “pre-contact” sites (i.e., the period of time prior to the arrival of Euroamericans) and deemed the impacts from that project to be small to moderate, and cumulative effects to be moderate.

The BLM has identified proposed coal-mining operations in the Powder Basin as well as continuing development trends. Impacts arising from development of mines, access roads, and related transportation infrastructure, such as extensions of railways, could have a varying effect on historical, cultural, and paleontological resources, depending on where they are sited, but such development is projected to increase at least over the next few years in the Powder River Basin. The same is true of quarries for sand, gravel, and scoria, all of which are used in road construction and maintenance.

CBM and oil and gas exploration and delivery are also expected to continue increasing with population growth and its attendant energy demands. These increases, however, are tempered by economic and regulatory factors. Development of these projects would also be similar to uranium-recovery projects, potentially involving the construction of access roads, pipelines, utility transmission lines, and support facilities of various types as well as ground-water-well installation and facility decommissioning activities.

Mitigation measures can reduce or minimize some impacts to historical, cultural, and paleontological resources. Sites could be deliberately avoided during construction, by flagging them or protecting them with a barrier. Careful monitoring during construction and the implementation of an inadvertent discovery plan can also provide a measure of avoidance or minimize impacts to sites as well as to paleontological discoveries. When impacts are unavoidable, data recovery is often proposed as mitigation measure. A Memorandum of Agreement (MOA) between the NRC, BLM, Wyoming State Historic Preservation Office (SHPO), the Applicant, and the respective Tribes would stipulate the management and treatment of discovered sites and would support ongoing consultation with the Tribes designed to avoid adverse impacts to archaeological sites, TCPs, and other cultural resources. Activities which are on Federally-managed lands or are subject to Federal licenses and permits would be expected to generate fewer impacts, as each is required to undertake the consultation process stipulated in Section 106 of the NHPA. Impacts can be greater on lands, including private or even State, that are not Federally administered. These would include impacts to physical remains as well as the integrity of their settings.

The *National Historic Preservation Act* (NHPA) provides regulatory thresholds for the assessment of impacts to historic properties, which would include the identification of the loss of characteristics that make the properties eligible for the NRHP as well as loss of integrity. For archaeological sites, these impacts could entail an incremental loss of data. For TCPs, these impacts could entail a gradual decline of the very qualities that make a property a functioning element, important for its role in maintaining a living culture.

While data recovery is a mitigation option that is often included in a treatment plan, archaeological sites are nonrenewable resources, and loss of any data contributes to the net loss of information on local and regional cultural history. Whether sites are removed by inadvertent destruction or intended data collection, this loss of these properties precludes any additional investigation in the future, when advances in the field could change interpretations or allow new methodologies to be applied. Paleontological resources are also non-renewable, and they are subject to the same cumulative risks.

Due to urbanization, population growth, and its attendant development, Tribal peoples are experiencing an ongoing loss of TCPs, places that play a vital role in maintaining and perpetuating cultural identity and values. Along with other threats to their life ways, the loss of any culturally empowering resource has a cumulative impact on a group's ability to maintain its cultural identity.

The NRC staff has concluded that the cumulative impacts on historical, cultural, and paleontological resources in the study area resulting from past, present, and reasonably foreseeable future actions is MODERATE to LARGE. The Ross Project would have a SMALL to LARGE incremental effect on historical, cultural, and paleontological resources when added to the MODERATE to LARGE cumulative impacts of the facilities and operations described above. However, the NRC staff's Section 106 consultation for the Ross Project is ongoing as are efforts to identify properties, determine effects, and develop mitigation measures to reduce impacts. The Ross Project is located within an archaeologically rich area; the activities described above could result in a cumulative loss of historical, cultural, and paleontological resources. The impacts to TCPs cannot be determined at this time as TCP identification is still ongoing, as described in Section 1.7.3.2 and Section 4.9. However, any past, present, and reasonably foreseeable future actions that occur on Federal land or require a Federal license or permit would require Section 106 consultations, which would be expected to ensure that historical, cultural, and paleontological resources are adequately protected.

5.13 Visual and Scenic Resources

The geographic area used in this analysis of visual and scenic cumulative impacts (the “visual-resources cumulative-impacts study area”) is a circular area with a 32-km [20-mi] radius around the Ross Project area. This area was established as the geographic boundary because it includes the recreational destinations in the immediate vicinity of the Ross Project (described in SEIS Section 3.10), and it addresses the highest (i.e., most sensitive) visual-classification areas in the vicinity of the Ross Project as well. Devils Tower, Thunder Basin National Grassland, Keyhole Reservoir State Park, and the Black Hills National Forest all fall within this visual-resources cumulative-impacts study area. As discussed in SEIS Section 5.3.2, the time frame evaluated for the cumulative-impacts analysis is 14 years, to the year 2027.

As described in SEIS Section 4.10, the potential impacts on visual and scenic resources from the Ross Project include the contrast of surface infrastructure (e.g., drilling rigs, the CPP, access roads, and utility lines) with the existing visual inventory. These types of visual impacts are consistent with the management objectives of the VRM Class IV area in which the Ross Project area is located. Thus, the potential impacts to visual and scenic resources from the surface structures and equipment of the Ross Project would be SMALL during all phases, except during construction phase. The short-term impacts to visual and scenic resources from construction activities would be MODERATE.

Many of the construction and operation activities (e.g., drilling, pipeline and wellfield installation, and surface infrastructure assembly, such as access-road, utility-corridor, and lighting-system construction) at the present and reasonably foreseeable future projects identified in SEIS Section 5.2, both uranium recovery as well as oil production, are very similar to those described in SEIS Section 4.10. In addition, the bentonite mine has already become a fixture of the landscape in the cumulative-impacts area. There are no coal mines within the 32-km [20-mi] radius of the visual and scenic resources cumulative-impacts area. Thus, the same types of impacts to visual and scenic resources described in SEIS Section 4.10 would be associated with these other mineral-extraction and energy-production activities that occur or could occur within the 32-km [20-mi] radius of the Ross Project.

All of these developments, however, would take place in the existing classifications of VRM Class III or IV, where change to an environment can be moderate or even undergo significant modification. In addition, many of the mitigation measures that would be used to reduce the contrast of the Ross Project structures with the existing visual inventory would also be required of new areas and projects. The lower profile and smaller footprint associated with the Ross Project, and presumably with the other satellite areas and planned ISR projects, would diminish visual impacts as well.

Thus, the NRC staff concluded that the cumulative impacts to the viewshed within the 32.2 km [20 mi] visual-resources cumulative-impacts study area as a result past, present, and reasonably foreseeable future actions would be MODERATE. The Ross Project would contribute a SMALL incremental impact and a MODERATE short-term incremental impact to the

MODERATE potential cumulative impacts to the viewshed within the 32.2 km [20 mi] visual-resources cumulative-impacts study area.

5.14 Socioeconomics

The geographic scope for this cumulative socioeconomics analysis are the six counties of Crook, Campbell, Weston, Sheridan, Johnson, and Converse, consistent with the geographic scope of the BLM's *Report for the Powder River Basin Coal Review Cumulative Social and Economic Effects* (BLM, 2005b), the "socioeconomics cumulative-impacts study area" for coal-related impacts. The timeframe for this analysis is 2013 through 2027.

The potential socioeconomic impacts of the Ross Project range from SMALL to MODERATE, with the MODERATE impacts associated with the benefits of the additional tax revenue projected to accrue to Crook County. Because the size and scope of the Ross Project relative to existing employment levels in a two-county ROI are small (see SEIS Section 4.11), and the Applicant is committed to hiring locally, the population impacts and the associated increase in demand for public and private services are expected to be SMALL.

There have been, however, a number of energy-related developments recently completed in the region as well as the proposed projects in the ROI that have the potential to cause additional impacts to socioeconomics areas of study. The projects considered in the BLM report cited above include two additional coal mines over the 2003 – 2010 period; 9,519 additional conventional oil and gas wells, with over one-half of these in place over the 2003 to 2010 period; 62,868 additional CBM wells, with about 40 percent of these in place over the 2003 – 2010 period; and 3 – 4 new coal-fired power plants, with three in place over the 2003 – 2010 period and 1 additional plant planned in the 2016 to 2020 period.

Socioeconomic impacts have been projected over both a low-production scenario and a high-production scenario. Under the low production scenario, the 2020 population in the six-county area is projected to increase by 24,100 persons over 2003 levels, reflecting an increase of 25.1 percent, with 55.8 percent of the increase attributed to projects already in place by 2010 (BLM, 2005b). Under the high-production scenario, the 2020 population in the six-county area is projected to increase by 28,625 persons over 2003 levels, reflecting an increase of 29.8 percent, with 54.0 percent of the increase attributed to projects already in place by 2010. Under both scenarios the large majority (over 70 percent) of the increase is projected in Campbell County, the regional commercial and services center for the region.

The population increases through 2010 already have shown up in the U.S. Census Bureau data for 2010. Population over the 2000 – 2010 period in Campbell County increased 36.9 percent and increased 20.3 percent in Crook County (see Section 3.11). In contrast, population growth in Wyoming was 14.1 percent per year over the same period.

Population increases associated with other current and proposed ISR projects in the ROI would be in addition to those discussed above. Some of the additional potential projects would involve only wellfield construction at satellite areas, including those associated with the Applicant's development of satellite areas in the Lance District. However, in this cumulative-impacts analysis, the NRC staff has assumed that the other planned ISR projects in the 80-km [50-mi] vicinity have the same construction and operating characteristics as the Ross Project, meaning that, at peak construction employment, including the employment associated with the Ross Project, all ISR projects within 80 km [50 mi] would create approximately 2,080 jobs. If these additional projects are online and operating through 2027, operation-phase employment levels would total approximately 540 jobs. If these other ISR projects follow the Applicant's local hiring and purchasing patterns, peak construction population increases would amount to an additional 436 residents in the two-county ROI while the operation-phase population increases by 2027 would total an additional 248 residents. The additional operation-phase population would increase the projected six-county population in 2027 to 24,348 residents, or a 25.4 percent increase over 2003 levels under the low-production scenario, and to 28,873 residents under the high-production scenario, or a 30.1 percent increase over 2003 levels.

Campbell County and local jurisdictions throughout the Powder River Basin have shown their ability to respond these periods of rapid growth. As an example, in response to Campbell County population increases of 36.9 percent over the 2000 – 2010 period, new housing construction increased 42.5 percent over the same period (USCB, 2002; USCB, 2012). Similarly, new housing construction in Crook County increased 22.5 percent compared to population growth of 20.3 percent over the same period.

Periods of rapid growth can stress other public and private service delivery systems. Over the 2010 – 2027 period, population in the six-county area, including the additional residents associated with operation-phase activities of the additional planned ISR projects, is projected to increase by another 10,900 persons, a 10.0 percent increase, under the low-production scenario, and another 13,419 persons, a 12.2 percent increase, under the high-production scenario. Under the low-production scenario, BLM (2005b) also projects enrollment in Campbell County School District No. 1 to increase by 1,587 additional students by 2020, reflecting a 22 percent increase over recent levels; this could cause short-term capacity shortfall. Under the high-production scenario, enrollments could increase another 10 percent. Water and waste-water systems in all communities in the six-county area would have the capacity to accommodate the projected increases in demand through 2020. However, if ongoing and planned improvements are completed (BLM, 2005b), short-term peak demands might result in the need for temporary rationing. This would be a MODERTAE impact.

While local county jurisdictions are expected to benefit from the increased tax revenues from these various projects, some directly from increased property taxes and others indirectly from worker spending and local purchases of goods and services from project proponents, this benefit would be offset by additional demands for public services. Additional street and highway improvements would likely be required in response to the increasing population as well (see SEIS Section 5.5) (BLM, 2009a). Increased traffic levels would also result in increased demand for law-enforcement services and emergency-response services, and similar increases in the demand for health services are expected.

Although the incremental socioeconomic impacts of the Ross Project are SMALL with MODERATE impacts to finance, as the cumulative population increases and their consequent impact on the demand for other public and private community services rises as well, there would be MODERATE socioeconomic cumulative impacts.

5.15 Environmental Justice

Because no minority or low-income populations, as defined by Executive Order 12898 have been identified in the Ross Project area, no disproportionate human-health and environmental impacts were determined. Therefore, there are no cumulative impacts expected in minority and low income populations near the Ross Project.

5.16 Public and Occupational Health and Safety

Cumulative impacts to public and occupational health and safety were assessed along the roads of the circular area defined by an 80-km [50-mi] radius around the Ross Project area (the "public and occupational health and safety cumulative-impacts study area"). This area includes the potential development of satellite areas within the Lance District by the Applicant, four other potential ISR projects, and the other past, present, and other reasonably foreseeable future projects described in SEIS Section 5.2. As described in SEIS Section 5.3, the timeframe for this cumulative-impacts analysis is 2013 to 2027, the expected lifecycle of the Ross Project, including potential uranium-recovery activities in the Lance District. There would be no potential impacts on public or occupational health and safety from the Ross Project following its license termination.

The public and occupational health and safety impacts from the proposed Ross Project would be SMALL and are discussed in Section 4.13. During normal activities associated with all phases of the project lifecycle, radiological and nonradiological worker and public health and safety impacts would be SMALL. Annual radiological doses to the population within 80 km [50 mi] of the proposed project would be far below applicable NRC regulations. For accidents, radiological and nonradiological impacts to workers could be MODERATE if the appropriate mitigation measures and other procedures to ensure worker safety are not followed. Typical protection measures, such as radiation and occupational monitoring, respiratory protection, standard operating procedures for spill response and cleanup, and worker training in radiological health and emergency response, would be required as part of the Applicant's NRC-approved Radiation Protection Program (RPP) (Strata, 2011a). These procedures and plans would reduce the overall radiological and nonradiological impacts to workers from accidents to SMALL.

As shown in Figure 5.1 and discussed in SEIS Section 5.2, in addition to the Ross Project, four satellite areas could be developed by the Applicant and four other ISR projects could be brought to construction and operation during the timeframe of this cumulative-impacts analysis. If constructed and operated, all of these facilities would have similar radiological and nonradiological impacts on the public and occupational health and safety to those at the Ross Project site. Potential radiological cumulative impacts from these facilities would result from incremental increases in annual radiological doses to the population when combined with the impacts of the proposed Ross Project. As stated in Section 4.13, for normal operations, Rn-222 and its progeny would be the most prevalent radionuclides, by dose contribution, anticipated to be released during normal operations at the proposed Ross Project. As further described in SEIS Section 4.13, the maximum expected exposure to a member of the public is estimated to be 0.008 mSv/yr [0.799 mrem/yr] and is consistent with estimates of exposure levels at other operating ISR facilities in the United States (NRC, 2009). This exposure, combined with exposures from other potential ISR facilities in the study area, would remain far below the 10

CFR Part 20 public dose limit of 1.0 mSv/yr [100 mrem/yr] and have a negligible contribution to the 6.2 mSv [620 mrem] average yearly dose received by a member of the public from all sources.

As described in SEIS section 4.13, both worker and public radiological exposures are addressed in NRC regulations at 10 CFR Part 20. Licensees are required to implement an NRC-approved RPP to protect workers and ensure that radiological doses are "as low as reasonably achievable" (ALARA). The Applicant's RPP includes commitments for implementing management controls, engineering controls, radiation safety training, radon monitoring and sampling, and audit programs (Strata, 2011a). Measured and calculated doses for workers and the public are often only a fraction of regulatory limits. Analyses of various radiological accident scenarios, described in section 4.13, also estimate that the dose to the public would be a fraction of the applicable regulatory limits.

Other developments in the 80-km [50-mi] area include existing and potential coal, oil, gas, and bentonite projects. The concomitant major nonradiological occupational hazards of all of these existing or future facilities would be similar to those at the Ross Project; that is, they would include slips, trips, and falls, which could then result in musculoskeletal injuries; potential exposures to excessive noise; potential inhalation of particulates, gasses, or vapors; and skin contact with corrosive materials. These impacts would only be present at the actual facilities where occupational risks are located; the distance between the facilities and operations in the public and occupational health and safety cumulative-impacts analysis study area suggests that, if an occupational hazard were to be experienced, such as a chemical release into the air, the distance itself would mitigate the resulting impacts and would limit impacts to the onsite workers.

All of the facilities and operations identified above would be required to implement the same or similar mitigation measures as at the Ross Project. For example, all such facilities would be required to have spill-response plans, Occupational Safety and Health Administration (OSHA)-compliant SOPs, and health and safety plans as a matter of course because all such facilities are subject to State and Federal occupational health and safety requirements. Thus, nonradiological cumulative impacts to occupational workers would be SMALL, since there would be no cumulative-effects between facilities or projects. However, in the unlikely event that an accident or spill is not mitigated, the impacts to workers could be MODERATE.

The cumulative impacts to the public from nonradiological normal operations would be SMALL, because the public would not have access to the facilities included in this cumulative-impacts analysis. Concurrent generation of fugitive dusts at various operations could occur, if they were closely located to each other, but these facilities would implement the same or similar BMPs for fugitive-dust and combustion-emissions control as described in SEIS Section 4.7. (See also SEIS Section 5.9 regarding air-quality cumulative impacts.) The very distance from the Ross Project to the other potential ISR, coal, gas, oil, and bentonite facilities preclude fugitive-dust cumulative impacts due to not only similar BMPs, SOPs, and other mitigation measures, but also due the significant winds in the study area which would disperse the fugitive dust rapidly.

Potential accidents and chemical releases could affect the public, depending upon the location of the release and the nearest receptors, the closest of which is 0.21 km [690 ft] from the Ross Project's boundary. Accidents could include bulk chemical spills during transport, during operations or maintenance, or during product or waste shipment. Spill prevention and response mitigation measures would include training of all personnel as well as standard spill-response plans. Coordination between both present and future ISR projects, especially the two that would use the same county roads as are adjacent to the Ross Project area (the Hauber and Elkhorn uranium-recovery projects), could optimize emergency-response activities and efficient response. Thus public impacts could range from SMALL to MODERATE, if accidents are not appropriately managed.

Because Strata will implement preventative and mitigation measures, the incremental impacts on public and occupational health and safety of the proposed Ross Project would be SMALL when added to the SMALL cumulative impacts of other past, present, and reasonably foreseeable future actions.

5.17 Waste Management

The cumulative impacts of waste management at the Ross Site were evaluated for both liquid and solid waste streams.

5.17.1 Liquid Wastes

There are two types of potential liquid waste disposal techniques that would be used at the Ross Project: those that employ deep-well injection and those that do not.

The Applicant estimates the completion of Ross Project’s (i.e., CPP’s) decommissioning and that of the Lance District satellite areas to be approximately 14 years after the NRC license would be issued. Since the impacts from deep-well injection would take some time to dissipate, 20 years is used as the timeframe for evaluation of these cumulative impacts (i.e., the year 2032). Except for the domestic sewage and the used oil, which would be managed only for the lifecycle of the Lance District satellite areas, the generation of other liquid wastes, such as excess permeate as well as fluids and ground water from monitoring wells, would cease during Ross Project operation and aquifer restoration, respectively.

5.17.1.1 Disposal by Deep-Well Injection

The geographic area selected for cumulative-impacts analysis for the management of liquid wastes into the UIC Class I deep-injection wells is similar to the area defined as the ground-water cumulative-impacts study area in SEIS Section 5.7. This area extends westward into the Powder River Basin, to the stratigraphic dip approximately 60 km [37 mi] west of the Ross Project, where the Cambrian aquifers targeted for waste injection at the Ross Project are over 3,700 m [12,000 ft] below the ground surface at that location. This depth to the aquifers make drilling Class I wells impractical; thus, the aquifers accessed at the Ross Project would not be penetrable at that western location. Also, at this location within the Basin, injection wells make use of the Upper Cretaceous aquifers at depths of 1,200 – 2,900 m [4,000 – 9,500 ft]. The aquifers in the Upper Cretaceous are: Tecla, Teapot, and Parkman members of the sandy intervals of the Pierre Shale; Lance and Fox Hills Formations; and the Tullock member of the Fort Union Formation above the Lance Formation. These aquifers are used for UIC Class I and Class V injection wells at existing uranium-recovery operations in Campbell, Johnson, and Converse Counties (NRC, 2010; NRC, 2011; WDEQ/WQD, 1999; WDEQ/WQD, 2010).

The other boundaries of the “waste-management cumulative-impacts study area” for deep-well injection would be the 80-m [50-mi] radius shown in Figure 5.1. This area includes the three ISR projects that may be located in Crook County (in addition to the Ross Project and the four Lance District satellite areas potentially operated by the Applicant) and another one just over the state line, in Montana. These potential projects were described earlier, in SEIS Section 5.2.

As described in SEIS Section 2.1.1.1, the liquid wastes generated by the Ross Project would include byproduct wastes, predominantly brine from the RO process and other process waters. These wastes would be stored in lined surface impoundments and then disposed of into the UIC Class I deep-injection wells, into the Deadwood and Flathead Formations (WDEQ/WQD, 2011). As noted earlier in SEIS Section 4.14, impacts of the management and disposal of liquid byproduct wastes into the UIC-permitted deep-injection wells at the Ross Project would be mitigated by the Applicant’s adherence to permit requirements and would be SMALL.

5.17.1.2 Disposal by Other Methods

The geographic area for cumulative impacts from soil disturbances, such as the mud pits at the drilling pads and the lined surface impoundments, is the circular area with an 80-km- [50-mi]-radius around the Ross Project area as shown in Figure 5.1.

Liquid non-byproduct wastes would include drilling fluids and muds from the installation of injection, recovery, and monitoring wells; small amounts of used oil; and domestic sewage. BMPs, management plans, and WDEQ permit requirements would be implemented to mitigate such waste-management and disposal techniques. For drilling fluids and muds, the respective management technique would be their evaporation and disposal in mud pits near each drillhole, and the pits would subsequently be reclaimed when the Ross Project area is restored to pre-licensing, baseline conditions. All used oils would be taken offsite to a properly permitted oil recycler. Finally, the domestic-sewage system installed onsite would follow the required standards and practices as well as all permitting requirements. Thus, as described in SEIS Section 4.14, the impacts of the management and disposal of liquid non-byproduct wastes at the Ross Project would also be SMALL.

Four potential uranium-recovery projects outside of the Lance District, but within 80 km [50 mi] of the Ross Project have been identified. These projects are located east and northeast of the Ross Project and would recover uranium from the lower Cretaceous Fall River and Lakota sandstones. They range from 11 – 70 km [7 – 44 mi] from the Ross Project. Uranium production at each of these potential ISR uranium-recovery projects is expected to be less than the Ross Project (Strata, 2012a). The area encompassing the Ross Project and future potential projects is approximately 0.5 million ha [1.3 million ac].

The use of UIC Class I deep-injection wells for the disposal of liquid byproduct wastes would be expected at these projects, if these projects were to become licensed. It appears likely, given the stratigraphy, that the same aquifers targeted by the deep-injection wells at the Ross Project would be used for disposal at these future projects. For example, the Dewey-Burdock uranium-recovery project in the eastern portion of the NSDWUMR, is stratigraphically similar to the future projects near the Ross Project. The Dewey-Burdock project, located in the Edgemont uranium district in South Dakota, would recover uranium from the Fall River and Lakota sandstones and has proposed deep-injection wells in the Minnelusa and Deadwood Formations, the same that would be used for the Ross Project (NRC, 2009; Powertech, 2010).

The U.S. Environmental Protection Agency (EPA) has determined that the area of potential impacts from deep-well injection is generally less than 0.4 km [0.25 mi] (EPA, 2001). Thus, EPA has defined an "area of review" as the zone of endangering influence around the well, or the radius at which pressure due to injection may cause the migration of the injected wastes and/or poor-quality water in the target formation into an underground drinking water source.

In addition, earthquakes induced by underground waste disposal have been rare, because typically large, porous aquifers are targeted and injection pressures are sufficiently low so that seismic activity is avoided (Nicholson and Wesson, 1990). Nicholson and Wesson documented only two instances in which waste disposal triggered significant adjacent seismicity. If earthquakes were to be induced by fluid-injection activities, they would be located within a few miles from the point of injection.

The WDEQ/WQD's UIC Class I Permit prescribes well design, injection rates, permitted wastes, and injection pressures. Careful monitoring is required to characterize post-licensing, pre-operational baseline water quality of the targeted aquifer and pressures of the lowermost drinking-water aquifer for a new well. Operational monitoring is required to record continuously the rate, volume, and pressure of injection. Every two years, wells must be tested to determine the radius of influence and to compare the results with historical and expected future responses. These required data would provide the information necessary for an assessment of cumulative impacts.

During this analysis, the NRC assumed that all five UIC Class I wells that are already permitted for the Ross Project would be installed and that an average of three UIC Class I wells would be installed at each of the four potential future projects near the Ross Project; thus, there would be 17 deep-injection wells within the approximately 0.5 million-ha [1.3 million-ac] area. The overall density of injection wells would consequently be very low. Given that the potential impacts from deep-well injection are localized, generally 0.4 km [0.25 mi], the cumulative impacts of disposal of liquid byproduct wastes would be SMALL, to which the Ross Project would contribute only a SMALL incremental impact.

5.17.2 Solid Wastes

The geographic area selected for solid waste-management cumulative-impacts analysis is the Ross Project area itself and, though disconnected, the areas that would be impacted by the actual disposal of each type of solid-phase waste that would be generated at the Ross Project (the "solid-waste-management cumulative-impacts study area). Because most of the waste-disposal facilities that would accept the Ross Project's wastes would be open through 2027, the NRC's waste-management cumulative-impacts analysis assumed that the cumulative impacts of waste management would occur through 2027.

The waste-management impacts of the Ross Project were determined to be SMALL in SEIS Section 4.14 through all of the Project phases. This impacts magnitude is primarily a result of the relatively small solid-waste volumes that would be generated at the Ross Project. Even during the decommissioning of the Ross Project, the volumes of the different types of solid wastes, including radioactive waste, would be relatively small due to the decontamination efforts anticipated by the Applicant as well as the fact that the Ross Project would not generate substantial quantities of waste when dismantled and/or demolished (uncontaminated equipment would be re-used).

For the waste-management cumulative-impacts analysis, the NRC assumed that all of the waste-disposal facilities that would accept and dispose of Ross Project wastes would have been properly licensed or permitted. (And that all Ross Project waste shipments would be managed as required in the pre-operational agreements the Applicant must set up with the respective waste-disposal facilities prior to uranium-recovery.) Every waste-disposal facility must undergo significant pre-operational planning and design. This is especially true for the radioactive-waste disposal facilities which could accept the Ross Project's radioactive waste. These facilities would have been licensed by the NRC or by an Agreement State; the other, non-radioactive facilities would have been permitted on the county- or State-level. Also, licensed or permitted facilities that generate solid byproduct material would be required to demonstrate that they have a valid agreement with a solid byproduct material disposal facility in order to continue to operate. This requirement would help to ensure that the byproduct disposal facilities have sufficient capacity to accept incoming material.

Consequently, the incremental impact of the Ross Project's waste management would be SMALL when considered with the SMALL cumulative impacts of waste management over the solid waste management cumulative-impacts study area.

5.18 References

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6 ENVIRONMENTAL MEASUREMENTS AND MONITORING

6.1 Introduction

As described in the Generic Environmental Impact Statement (GEIS), monitoring programs are developed for in situ recovery (ISR) facilities to verify compliance with the applicable standards and requirements for the protection of worker health and safety in active uranium-recovery areas (i.e., both the facility and the wellfields) and for protection of the public and the environment beyond the licensed facility's boundary (NRC, 2009). Monitoring programs provide data on operating and environmental conditions so that prompt corrective actions can be implemented when adverse conditions are detected. It is important to note that the management of spills and leaks is not considered part of a routine environmental monitoring program (NRC, 2009). Potential spills and leaks are described in this Supplemental Environmental Impact Statement's (SEIS) Section 2.1.1, including the design components and management techniques that are intended to detect and to minimize the impacts of spills and leaks.

This section discusses the types of environmental monitoring activities that the Applicant would undertake throughout the Ross Project. These include radiological, physiochemical, meteorological, and ecological monitoring activities.

6.2 Radiological Monitoring

Radiological effluent and environmental monitoring programs are required for an U.S. Nuclear Regulatory Commission (NRC)-licensed facility. The purpose of the monitoring programs is to (i) characterize existing levels of radiological materials in the environmental media, (ii) provide data on measurable levels of radiation and radioactivity in the effluent and environmental media during the operational life of the facility, and (iii) evaluate principal pathways of radiological exposure to the public. This section describes Strata's proposed radiological monitoring programs for the Ross ISR Project as described in its license application and supporting documents and subsequent responses to NRC requests for additional information.

In accordance with 10 CFR Part 40, Appendix A, Criterion 7, an Applicant is required to establish a pre-operational monitoring program to establish facility baseline conditions prior to construction. Results of Strata's baseline radiological monitoring program are presented in SEIS Section 3.12.1. After establishing baseline conditions, an ISR facility operator must conduct an operational monitoring program to measure or evaluate compliance with standards and environmental impacts of an ISR facility under operational conditions. In accordance with 10 CFR Part 40.65, the license must submit to NRC a semiannual effluent and environmental monitoring report which would specify the quantity of each of the principal radionuclides released as effluent or their levels within various environmental media in all unrestricted areas during the previous 6 months of operation. This report would also provide other NRC required information to estimate the maximum potential annual radiation doses to the public resulting from effluent releases.

The following sections briefly describe the Applicant's proposed operational monitoring program. NRC Regulatory Guide 4.14 (NRC, 1980) provides guidance for establishing radioactive effluent and environmental monitoring programs for uranium mills, which includes ISR facilities. A summary of the effluent and environmental monitoring program is presented in Table 6.1.

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Table 6.1 Summary of the Major Elements of the Ross Project Operational Environmental Monitoring Program

Table 6.1. Summary of the Major Elements of the Ross Operational Environmental Monitoring Program

Program Element	Location	Radionuclides Analyzed	Sampling Frequency	Number of Sampling Locations
Ground water – Monitor Wells	Up-gradient and down-gradient from CPP	Dissolved uranium, Ra-226, Th-230, Pb-210, Po-210, gross alpha, gross beta	Monthly first year, quarterly thereafter	3 or more down-gradient;at least up-gradient control sample
Ground water - Water Supply Wells	Private wells within 3.3 km (2mi) of project area similar to the pre-operational baseline monitoring	Dissolved and suspended uranium, Ra-226,Th-230, Pb-210, Po-210, gross alpha, gross beta	Quarterly	29
Surface Water (1)	Surface waters passing through project area and reservoirs subject to runoff similar to pre-operational baseline monitoring	Dissolved and suspended uranium, Ra-226,Th-230, Pb-210, Po-210, gross alpha, gross beta	Quarterly (as available)	3 surface water monitoring stations and11 reservoirs within project area
Air Particulates	Locations with the highest predicted concentrations, nearest residences and control location similar to pre-operational baseline monitoring	Total uranium, Th-230, Ra-226,Pb-210	Continuous - Composites of weekly filters analyzed quarterly	5 or more
Radon in Air	Particulate in air locations and other areas of interest similar to pre-operational baseline monitoring	Rn-222	Continuous viaTrack-Etch units – quarterly exchange and analysis of units	5 or more
Soil	Particulate in air locations and other locations with the highest predicted concentrations similar to pre-operational baseline monitoring	Total uranium,Ra-226, Pb -210,gross alpha	Annually	5 or more
Sediment	Surface waters passingthrough project area and reservoirs subject to runoff similar to pre-operational baseline monitoring	Total uranium,Ra-226, Pb -210,gross alpha	Annually (as available)	3 surface water monitoring stations and 11 reservoirs within project area
Direct Radiation	Particulate in air locations and other areas of interest similar to pre-operational baseline monitoring	Continuous via TLD	Quarterly	5 or more
Vegetation (2)	Animal grazing areas and other locations with the highest predicted concentrations similar to pre-operational baseline monitoring	Ra-226 and Pb-210	Three timesduring grazing season	Grazing vegetation representing 3 different sectors that have the highest predicted concentrations of radionuclides
Animal Tissue	Livestock (cattle) raised within 3 km of the site and fish from Oshoto Reservoir similar to pre-operational baseline monitoring	Ra-226 and Pb-210	Once during site decommissioning and prior to license termination	3 samples of beef; 1 fish sample (composite to meet laboratory MDL)

(1) Location of air particulate samplers used during the preoperational baseline monitoring will be re-evaluated for operational monitoring based on results of the pre-operational meteorological monitoring program and the results of the MILDOS-AREA analysis to insure at least 3 locations are selected representing 3 different sectors that have the highest predicted concentrations of radionuclides

(2) In accordance with the provisions of NRC Regulatory Guide 4.14, Footnote (o) to Table 2: "*vegetation and forage sampling need be carried out only if dose calculations indicate that the ingestion pathway from grazing animals is a potentially pathway...*" defined as a pathway which would expose an individual to a dose in excess of 5% of the applicable radiation protection standard. This pathway was evaluated by MILDOS-AREA.

Source: Table 5.7-1 (Strata, 2011a)

6.2.1 Airborne Radiation Monitoring

The Applicant proposes to conduct continuous air particulate sampling at five locations identified in Figure 6.1. The filters from air samplers will be analyzed on a weekly basis, or more frequently if required due to dust loading, for natural uranium, Th-230, Ra-226, and Pb-210 in accordance with Regulatory Guide 4.14 (Strata, 2011a; NRC, 1980). The air samplers will be calibrated per manufacturer recommendations or at least semiannually with a mass flow meter or other primary calibration standard (Strata, 2011a).

In addition to the air particulate sampling, passive track-etch detectors and thermoluminescent dosimeters (TLDs) will be deployed at each air particulate monitoring station (Strata, 2011a). The passive track-etch detectors will provide continuous monitoring of Rn-222 and the detectors will be exchanged and analyzed on a monthly basis. The TLDs will be used to assess gamma exposure rates continuously at each air particulate monitoring station. The TLDs will be exchanged and analyzed on a quarterly basis.

During operations, Strata will monitor radon gas and passive gamma radiation using Landauer radon Trak-Etch detectors and environmental low level TLDs at locations shown in Figure 6.1. In total, radon will be monitored at 17 sampling locations, of which five locations are co-located with the air particulate samplers, as recommended in Regulatory Guide 4.14 (NRC, 1980).

6.2.2 Soils and Sediment Monitoring

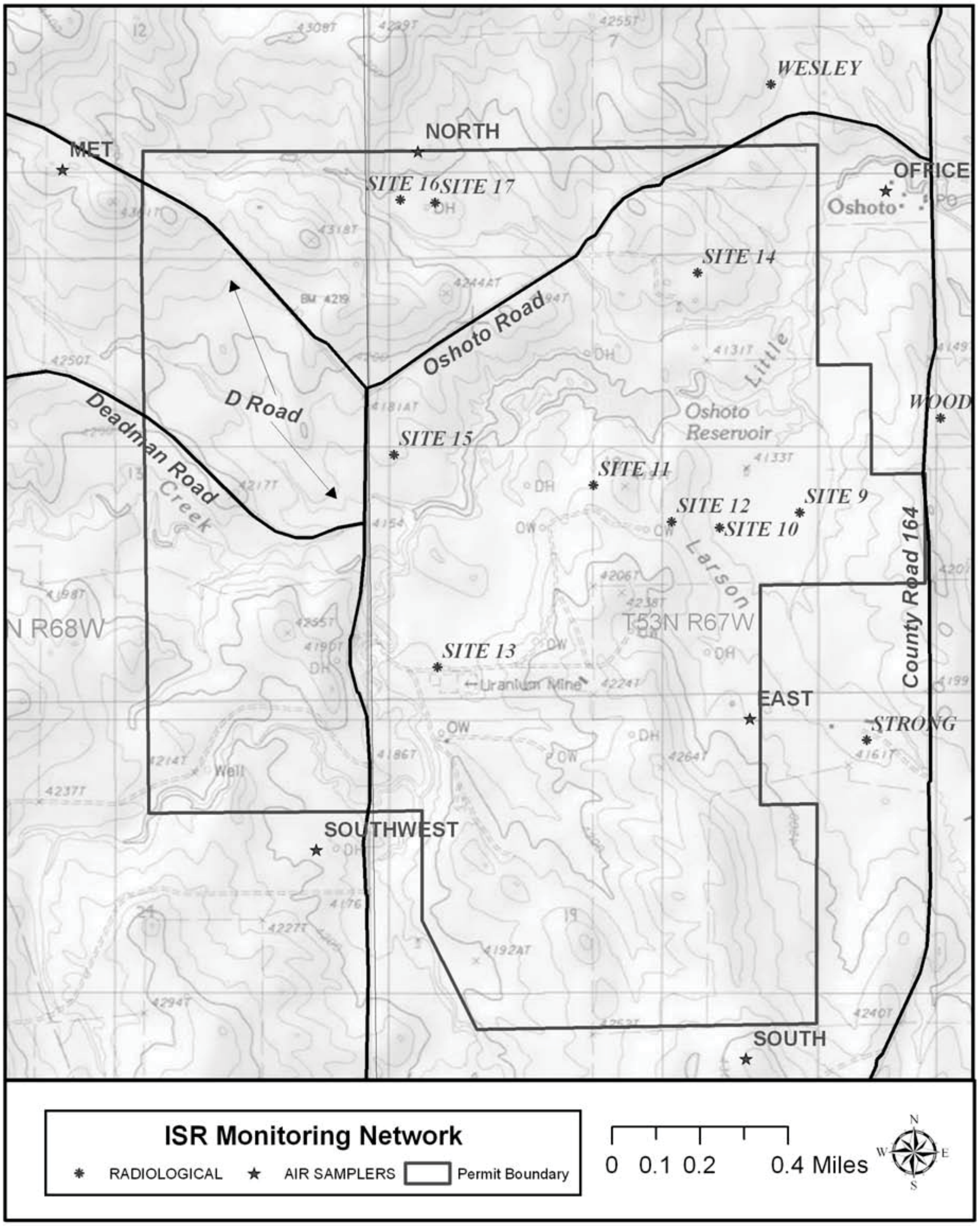
The Applicant proposes to collect representative soil samples to a depth of 152 cm (60 in) annually at each of the five air particulate monitoring stations shown in Figure 6.1. The soil samples will be collected similar to the baseline collection procedure (i.e., two surficial samples (to a depth of 15 cm) and two subsurface samples. The samples will be analyzed for natural uranium, Ra-226, Pb-210 and gross alpha (Strata, 2011a).

The Applicant proposes to collect sediment samples annually at the three surface water gaging stations on Little Missouri River and Deadman Creek and from the Oshoto reservoir. The sediment sampling at the stream gaging stations will occur during a runoff event between April and October. The sediment samples will be analyzed for natural uranium, Th-230, Ra-226, and Pb-210 and gross alpha (Strata, 2011a).

The proposed sampling and analyses are consistent with recommendations of Regulatory Guide 4.14 (NRC, 1980). Similarly, the analytical limits of detection for the soil and sediment sampling program are consistent with the recommendations of Regulatory Guide 4.14 (NRC, 1980) unless matrix interferences prohibit attainment of these low detection limit goals.

6.2.3 Vegetation, Food, and Fish Monitoring

Where a significant pathway to man is identified, Regulatory Guide 4.14 suggests analyzing three of each type of crop, livestock, etc., raised within 3 km of the ISR site (NRC, 1980). Vegetation samples should be collected three times during the grazing season, and food and fish samples should be collected at the time of harvest or slaughter.



Source: Figure 3 of Addendum 3.6-A to the environmental report (Strata, 2011a)

Figure 6.1
Ross Project Meteorological and Baseline Radiological Monitoring Locations

All should be analyzed for Ra-226 and Pb-210. Note (o) in Regulatory Guide 4.14 (NRC, 1980), Table 2 clarifies that an exposure pathway should be considered important if the predicted dose to an individual would exceed 5 percent of the applicable radiation protection standard. Individual members of the public are subject to the dose limits in 10 CFR Part 20.1301. Pursuant to 10 CFR Part 20.1301, the dose limit is 100 mrem/yr Total Effective Dose Equivalent (TEDE).

The Applicant has established a pre-operational baseline. Based on modeling (i.e., MILDOS-Area), the Applicant calculates that maximum impacts to the public through all pathways would be less than 1 percent of the applicable radiation protection standard (Strata, 2011a). Therefore, because the Applicant has determined that a significant pathway to man does not exist from these sources, the Applicant does not propose to perform any vegetation, food or fish sampling during operations (Strata, 2011a). However, the Applicant states that in the event that monitoring is required, it proposes to follow the protocol used in baseline sampling for three vegetation samples during the grazing season at three locations at which the model-predicted concentrations were the highest. The Applicant proposes to collect samples of animal tissue and fish from the Oshoto Reservoir during site decommissioning.

NRC staff includes a license condition for the Applicant to establish a plan for verifying the input values used in the MILDOS-Area calculations by monitoring the effluent discharges. Should the effluent discharges invalidate the model calculations, the Applicant will be required to recalculate the model and/or verify the radiological impacts to the vegetation and food sources through routine sampling.

6.2.4 Surface Water Monitoring

During the construction phase, the Applicant proposes to conduct a surface water monitoring program consisting of sampling at the Oshoto reservoir and three on-site stream gaging stations (SW-1, SW -2 and SW-3) located within Deadman Creek or Little Missouri River (Strata, 2011a). The Applicant anticipates that, based on the preoperational monitoring program, flows in the streams will likely be ephemeral primarily during April to October (Strata, 2011a). Surface water is found year-long in the Oshoto reservoir.

During operations, the Applicant proposes to conduct a surface water monitoring program which was conducted during the pre-operational monitoring, i.e., quarterly sampling at three on-site stream gaging stations and 11 on-site or nearby reservoirs. The parameters to be analyzed for the operational surface water monitoring program are dissolved and suspended uranium, Th-230, Ra-226, Po-210 and Pb-210, and, gross alpha and gross beta unless sufficient cause can be demonstrated to measure a parameter less frequently.

The Applicant also commits to monitoring surface water should monitoring be required for a Wyoming storm water discharge permit through the WYPDES program (Strata, 2011a).

6.2.5 Groundwater Monitoring

The Applicant proposes to monitor groundwater quality at the domestic, livestock, and industrial water supply wells located within a 2 km [1.2 mi] radius of the Ross Project boundary during both construction and operation phases. The Applicant states that monitoring of the nearby water supply wells will be conducted quarterly and results provided to NRC on an annual basis.

The monitoring at a specific water supply well will be contingent upon landowner's (well owner's) consent and, for a variety of reasons (e.g., abandoned, non-functioning pump, winterized), may not be available every quarter (Strata, 2011a). The parameters to be analyzed consist of dissolved and suspended uranium, radium-226, thorium 230, lead-210 and polonium-210, and gross alpha and gross beta.

The Applicant estimates that 29 wells exist within 2 km [1.2 mi] of the Ross Project (Strata, 2011a). Based on information in the application, the water supply wells consist of 2 industrial water supply wells, 15 livestock water supply wells and 12 domestic water supply wells of which four livestock water supply wells and three industrial wells are located within the Ross Project area. The proposed monitoring program is a continuation of the pre-operational monitoring program though the parameters analyzed will be reduced from those analyzed in the pre-operational monitoring program.

By license condition, NRC staff will require that nearby water supply wells within 2 km [1.2 mi] of an active wellfield be sampled in lieu of 2 km [1.2 mi] of the project area. In addition, other license conditions will require an annual update on the nearby ground water use and require monitoring of the onsite industrial wells on a monthly basis for the effluent monitoring program if operations at the industrial wells have not been terminated.

6.3 Physiochemical Monitoring

This section describes the monitoring program proposed by the Applicant that would be initiated in compliance with applicable environmental regulations and the NRC license. This monitoring program would allow an evaluation of changes in the chemical and physical environment as a result of the proposed Ross Project. The physiochemical monitoring program would include surface water and ground water as well as flow and pressure monitoring of wellfields and pipelines as described in this section.

Pre-licensing, baseline monitoring of surface water and ground water was completed by the Applicant in 2009 and 2010, and the acquired data were used to characterize the Ross Project site according to the requirements in 10 CFR Part 40, Appendix A, Criterion 7 (Strata, 2011a). Sample collection and analysis were performed according to the recommendations found in NRC's Regulatory Guide 4.14 (NRC, 1980) as well as the specifications in ASTM D449-85a (now superseded by ASTM D4448-01), *Standard Guide for Sampling Groundwater Monitoring Wells*. In addition, the Applicant also provided supplemental environmental monitoring data in 2012 (Strata, 2012).

The surface-water monitoring stations and ground-water monitoring wells established for pre-licensing baseline monitoring would be incorporated into the post-licensing, pre-operational data-collection effort and into the active operation-phase environmental-monitoring network.

6.3.1 Surface-Water-Quality Monitoring

The Applicant proposes to continue quarterly sampling of the surface-water stations that were established for pre-licensing baseline water-quality data (Strata, 2011b). The existing surface-water monitoring stations include the Oshoto Reservoir and three surface-water monitoring stations; these surface-water stations are located on the Little Missouri River (SW-1 and SW-2) and on Deadman Creek (SW-3) (see Figure 3.12). The Applicant would add additional stations as necessary to meet additional NRC license conditions. Each station is already equipped with a pressure transducer, a data-logging system, and a runoff-event-activated sampling mechanism.

6.3.2 Ground-Water-Quality Monitoring

The Applicant proposes a ground-water monitoring program to acquire post-licensing, pre-operational data in order to establish the parameters (i.e., constituent concentrations) necessary to detect excursions outside the ore zone during active uranium-recovery operation and to observe aquifer-restoration performance as it proceeds (Strata, 2011b). The post-licensing, pre-operational baseline data would be collected from each individual wellfield as it is completed, but prior to the Applicant's initiating uranium recovery. Each wellfield's monitoring data would be used to establish NRC-approved upper control limits (UCLs) in accordance with 10 *Code of Federal Regulations* (CFR) Part 40 Appendix A Criterion 5B(5) (i.e., constituent concentration-based values for excursion detection and aquifer-restoration performance assessment). Thus, the excursion indicators (or "excursion parameters") and the aquifer-restoration target values would be wellfield specific.

Monitoring wells would be installed in the ore zone to establish post-licensing, pre-operational baseline water quality for each "mine unit" (i.e., wellfield) (see Figure 2.4 in SEIS Section 2.1.1.). In addition, monitoring wells would be installed around each wellfield as well as into the overlying and underlying aquifers. Impending potential excursions to adjacent geologic units and progress toward meeting aquifer-restoration targets would be monitored by the Applicant's sampling designated wells within the wellfields during operation and during aquifer-restoration. These samples would be analyzed by a laboratory and would yield constituent-concentration data.

6.3.2.1 Post-Licensing, Pre-Operational Ground-Water Sampling and Water-Quality Analysis

The baseline ground-water monitoring program, which has been used for the last three years at the Ross Project area, would be expanded from the pre-licensing monitoring wells installed for site characterization, to a program designed to generate data specific to a mine unit, as needed. This program would be codified in the NRC license. The post-licensing, pre-operational monitoring program would provide data to establish UCL constituent concentrations that would be used by the Applicant to identify potential horizontal excursions of lixiviant outside of a wellfield and potential vertical excursions into the overlying or underlying aquifers (Strata, 2011b). The spacing, distribution, and the number of monitoring wells would be site specific and would be codified in the NRC license (NRC, 2009).

The Applicant proposes the installation of one well cluster for every four wellfield acres for their post-licensing, pre-operational data-collection program, which is consistent with the range the of one well per 0.4 ha [1 ac] to one well per 1.62 ha [4 ac] in the GEIS and the SRP (NRC, 2009, 2003), and historically used at existing ISR facilities. At the time of preparation of this manuscript, NRC staff has developed a draft license condition to require a minimum density of one well per 0.8 ha [2 ac] for the Commission-approved background based on staff's evaluation of site-specific geologic and hydrogeologic conditions, and the applicant's proposed sequencing and area of individual wellfield modules.

The Ross Project would include approximately 45 wells completed in the ore aquifer (30 – 55 m [100 – 180 ft]-thick sand interval) in the lower Lance/Upper Fox Hills Formations (designated as the ore-zone [OZ] unit) to establish baseline data. At approximately half of those location (24 locations), an additional well will be completed in the underlying aquifer (3 – 9 m [10 – 30 ft] thick sandy interval in the Fox Hills Formation (designated as the deep-monitoring [DM] unit below the ore zone) and the overlying lying aquifer in the first water-bearing unit above all mineralized zones in the Lance Formation (designated as the SM unit) forming a three-well cluster at those locations. The wells completed in the SM and DM units would use a fully penetrating completion while the ore-zone wells would target specific roll fronts (see Figures 2.8 – 2.10). Beyond the six existing well clusters used for pre-licensing baseline monitoring and site characterization, the Applicant proposes no additional surficial-aquifer (SA) wells for the wellfield areas; however, by license condition, the Applicant would be required to monitor the uppermost SA aquifer for wellfields which overly the SA aquifer that is found at shallow depths and is comprised of alluvial deposits associated with the recent stream channels.

For post-licensing, pre-operational water-quality characterization of the wellfields, the Applicant proposes to obtain at least four samples, with a minimum of two weeks between sampling events, for all perimeter, SM, OZ, and DM baseline wells. In addition, the SA-well network would continue to be sampled on a quarterly basis through the wellfield data-acquisition phase before final licensing for uranium recovery. The first and second sampling events would include laboratory analyses for constituents listed in GEIS Table 8.2-1 (NRC, 2009). The Applicant also proposes a reduced list of constituents for the third and fourth sampling events, which would be informed by the results of the previous two sampling events. Results from the sample analyses would be averaged arithmetically to obtain an average value as well as a maximum value for use in the NRC's determination of UCLs for excursion detection. The Applicant's proposed monitoring program would be modified as required by the NRC license.

6.3.2.2 Operational Ground-Water Sampling and Water-Quality Analysis

As described in GEIS Section 8.3.1.2, the placement of monitoring wells would occur around the perimeter of wellfields, in the aquifers both overlying and underlying the ore zone, and within the ore-zone aquifer for the early detection of potential horizontal and vertical excursions of lixiviant (NRC, 2009). The spacing, placement, and number of monitoring wells would be site-specific and would be established by the NRC in its license to the Applicant (NRC, 2009).

Three configurations of monitoring wells would be constructed to ensure detection of horizontal and vertical excursions: wells through the entire targeted ore zone (i.e., the ore body) at the perimeters of the wellfields; wells completed in the aquifer underlying the ore zone; and wells completed in the aquifer overlying the ore zone (Strata, 2011b). The design of a typical monitoring well is described in SEIS Section 2.1.1 (see also Figures 2.8 – 2.10). To detect whether an excursion of lixiviant has occurred, the monitoring results would be compared against the NRC-approved UCLs.

The Applicant proposes well spacing that meets the minimum requirement described in the GEIS as necessary to detect excursions (NRC, 2009). However, NRC staff has developed a draft license condition to require a minimum density of one well per 0.8 ha [2 ac] for the Commission-approved background based on NRC staff's evaluation of site-specific geologic and hydrogeologic conditions, and the applicant's proposed sequencing and area of individual wellfield modules. Wells completed in the aquifer underlying the ore zone and in the aquifer overlying the ore zone would be installed at a density of one well per 1 – 2 ha [3 – 4 ac] of wellfield to detect vertical migration. The Applicant proposes a spacing of the perimeter monitoring wells of 120 – 180 m [400 – 600 ft] apart and at a distance of approximate 120 – 180 m [400 – 600 ft] from the edge of the wellfield to detect potential horizontal excursions. Simulations by the Applicant demonstrate that the proposed well spacing successfully detects hydraulic anomalies in the form of water-level increases well before lixiviant has actually moved beyond the active uranium-recovery areas (Strata, 2011b).

The Applicant proposes that samples from these monitoring wells would be collected every two weeks to be analyzed for the excursion parameters (i.e., constituents) (Strata, 2011b). In addition, dedicated pressure transducers and/or in situ water-quality instruments would be used in the perimeter monitoring wells to provide early detection of potential excursions or hydraulic anomalies. Water levels would be routinely measured during well sampling in the perimeter, overlying, and underlying monitoring wells in order to provide an early warning for impending wellfield problems. An increasing water level in a perimeter monitoring well has been shown to be an indication of a local-flow imbalance within the wellfield, which could result in a lixiviant excursion. An increasing water level in an overlying or underlying monitoring well could similarly be caused by the migration of lixiviant from the ore-zone aquifer, or it could indicate an injection well-casing failure. This monitoring would allow immediate corrective actions, thus reducing the likelihood of excursions.

6.3.3 Flow and Pressure Monitoring of Wellfields and Pipelines

In GEIS Section 8.3.2, the monitoring of flow rates and pressures of lixiviant pumped to injection wells and from recovery wells is described. These monitoring data would be used by the Applicant to manage the water balance for the entire wellfield and to maintain an inward gradient to reduce the likelihood of excursions (NRC, 2009). To manage the water balance at the Ross Project, the Applicant proposes flow meters and pressure transmitters on each of the pipelines between the module building and injection and recovery wells. All instrumentation would be monitored at the module building and at the central processing plant (CPP). The wellfield flows would be balanced based on the module injection and recovery feeder-line meters. An individual well's flow targets would be determined on a per-well-pattern basis to ensure that local wellfield areas are balanced on at least a weekly basis. The maximum injection pressure would be less than the formation's fracture pressure.

Each module building would have the capability of being isolated from the pipelines by manually operated butterfly valves contained in the manholes exposing the pipelines. The manholes would have leak-detection devices that would activate an audible and visible alarm at the CPP in the event of a leak. Pressure transmitters on each end of the trunk lines and feeder lines would relay pressure readings back to the CPP's control room. In the event of a pressure reading that is outside of acceptable operating parameters, an audible and visible alarm would occur at the CPP. Automatic sequential shutdown of the trunk-line pumps and/or module-building booster pumps and recovery-well pumps would then occur if operating parameters do not return to normal ranges within a specified amount of time.

6.4 Meteorological Monitoring

The Applicant proposes to continue operating the meteorological monitoring station installed in January 2010 as part of its site-characterization baseline monitoring program (Strata, 2011a).

The data collected at this station would include continuous measurements of wind speed, wind direction, temperature, relative humidity, precipitation, and evaporation.

6.5 Ecological Monitoring

Ecological monitoring would include both vegetation and wildlife surveys.

6.5.1 Vegetation Monitoring

The Applicant proposes to monitor all disturbed areas on the Ross Project area for the presence of undesirable (i.e., noxious or invasive) species and to use control measures to prevent their spreading. Vegetation monitoring in reclaimed areas would be conducted according to U.S. Bureau of Land Management (BLM) and Wyoming Department of Environmental Quality (WDEQ) requirements and would be in accordance with the decommissioning requirements that would be included in the Applicant's NRC license (Strata, 2011a). Revegetation success would be monitored by the "extended reference area" concept, as defined in WDEQ/Land Quality Division (LQD), Guideline No. 2 (Strata, 2011a). The extended reference area would include all of the undisturbed portions of any vegetation type which has experienced disturbance in any phase of the Ross Project. At the end of decommissioning, quantitative vegetation data for extended reference areas representing each disturbed vegetation type would be directly compared by statistical analysis to quantitative vegetative data from reclaimed vegetation types. The duration of vegetation monitoring, and the target goals, would be defined in the final decommissioning plan required by the NRC license.

6.5.2 Wildlife Monitoring

The Applicant proposes annual wildlife surveys in and near the Ross Project area throughout the lifecycle of uranium-recovery activities in order to document key wildlife species, population trends, and habitats (Strata, 2011a).

6.5.2.1 Annual Reporting and Meetings

The Applicant would coordinate its wildlife-monitoring program with the BLM's Newcastle Field Office and the Wyoming Game and Fish Department (WGFD). Consultation with the U.S. Fish and Wildlife Service (USFWS), BLM, and WGFD would be conducted prior to the Applicant's initiating a survey and would be documented in a work plan, with BLM and WGFD concurrence. The Applicant would prepare an annual monitoring report and submit it to the BLM, WGFD, and other interested parties by November 15 of each year. The monitoring report would include:

- Survey methods and results as well as observations of any trends and assessments of wildlife-protection measures implemented during the past year;
- Recommendations for changes in wildlife-protection measures for the coming year;
- Recommendations for modifications to wildlife monitoring or surveying; and
- Recommendations for additional species to be monitored (e.g., a newly Federal- or State-listed species).

Data and mapping would be formatted to meet BLM requirements (i.e., geographic information systems data and maps).

6.5.2.2 Annual Inventory and Monitoring

Wildlife surveying and monitoring would be performed by BLM or WGFD biologists or a qualified scientist under contract to the Applicant. All aspects of a regular and/or periodic monitoring program would be developed according to current regulatory and permitting guidelines and requirements. These would include field-survey and survey-equipment requirements; data collection, analysis, reporting, and storage procedures; agency consultations and collaborations; and any other relevant survey- and monitoring-program components.

6.5.2.3 Wildlife Species

Mammals and certain birds as well as all wildlife on the BLM Sensitive Species (BLMSS), WSOC, and USFWS's SMC lists at the Ross Project area would be monitored in the Applicant's wildlife monitoring program.

Mammals

Opportunistic observations of all wildlife species would be conducted in late spring and summer, during the Applicant's completion of the surveys discussed below for sensitive species. No big-game crucial ranges, habitats, or migration corridors are recognized by the WGFD at the Ross Project area or the surrounding 1.6-km [1-mi] perimeter. A "crucial" range or habitat is defined as any particular seasonal range or habitat component that has been documented as the determining factor in a population's ability to maintain and reproduce itself at a certain level. Due to the lack of crucial big-game habitats, the WGFD did not require big-game surveys during pre-licensing baseline monitoring the Applicant performed in 2009 and 2010 (Strata, 2011a). Long-term monitoring for big game is not anticipated and has not been proposed by the Applicant.

Protected Species and Other Birds

The Applicant proposes to monitor protected species, using the following strategy (Strata, 2011a):

- Early spring surveys for and monitoring of sage-grouse leks within 2 km [1.2 mi] of the Ross Project area. All threatened and endangered species as well as those on the BLMSS, Wyoming Species of Concern (WSOC), and USFWS's "Migratory Bird Species of Management Concern in Wyoming" (SMC) lists would be surveyed and monitored on the Ross Project area as well.
- Late spring and summer opportunistic observations of all wildlife species, including threatened, endangered, BLMSS, WSOC, SMC, and any other species of concern would occur and noted.
- Any other surveys as required by regulatory agencies.

Raptors

Only one raptor's nest was previously identified on the Ross Project area, and the opportunity for nesting is limited in the area due to a lack of suitable habitat (i.e., trees and cliffs). However, the Applicant has committed to completing the following:

- Early-spring surveys for new and/or occupied raptor territories and/or nests, and
- Late-spring and summer surveys for raptor reproduction at occupied nests.

The nearest human disturbance to active and inactive raptor nests, any visual barriers in the line of sight of raptor nests, and the prey abundance (e.g., jackrabbits and cottontails) would be reported in each annual report to allow an assessment of whether any raptor disturbance is related to uranium-recovery activities.

Migratory Birds

The Applicant would conduct nesting-bird surveys for nongame species during early summer, following recommended WDEQ techniques. All birds, observed or heard, and the vegetation and habitat type where they might be found would be recorded. These surveys would document all high-interest bird species identified by the BLM, WGFD, and USFWS.

6.6 References

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7 COST-BENEFIT ANALYSIS

This section summarizes the benefits and costs associated with the Proposed Action and the two Alternatives. The discussion of costs and benefits follow the U.S. Nuclear Regulatory Commission (NRC) guidance presented in NUREG–1748 (NRC, 2003). The discussion of the costs and benefits include both the costs of each Alternative and a qualitative discussion of environmental impacts, as applicable.

7.1 Proposed Action

Benefits of the Proposed Action include the additional employment opportunities available to area residents, increased incomes to area residents, and additional tax revenues accruing to local jurisdictions and the State of Wyoming. Potential costs include both the internal costs of the Ross Project borne by the Applicant and the potential external monetary costs that may be required by local public-service providers in response to Project activities as well as non-monetary costs associated with the potential environmental impacts.

7.1.1 Ross Project Benefits

The economic benefits of the Ross Project would be positive for Crook County and generally positive for residents directly or indirectly affected by the Project. The Applicant is committed to hire local personnel and to make equipment purchases at local suppliers whenever possible (Strata, 2012), maximizing the economic benefits to Crook County and neighboring counties.

7.1.1.1 Employment and Income

The Ross Project is expected to require a peak workforce of approximately 200 workers during its construction phase; 60 workers during operation; 20 – 30 workers during the aquifer-restoration phase; and 90 workers for decommissioning activities (see Supplemental Environmental Impact Statement [SEIS] Section 4.11). This employment would be beneficial because it would reduce the local unemployment rate for the duration of construction, and some workers would likely stay through the operation phase of the Ross Project. It is expected that workers would be paid the regional rates typical of Crook and Campbell Counties, where a higher percentage of jobs are in the relatively higher-paying energy industry. Based upon weighted average annual earnings per job of $61,400 (see SEIS Section 3.11), earnings accruing to area residents would range from $1.2 million to $1.8 million during the aquifer-restoration phase to approximately $12.3 million during the Ross Project's construction phase. In addition, existing private-property landowners at the Ross Project area would be compensated for the loss of use of their land; however, the specific terms of this compensation is unknown.

7.1.1.2 Tax Revenues

Average annual tax revenues are estimated to be $2,785,000 per year during the Ross Project's operation (see Section 4.11.1) and would total $27,850,000 over the lifecycle of the Project. The State of Wyoming would benefit, in part, from the severance and royalty payments, estimated to be $10.9 million over the lifecycle of the Ross Project, whereas Crook County would benefit from the gross production and property taxes, totaling $16.9 million over the lifecycle of the Project. In addition, some portion of the State severance and royalty payments would be distributed among all Wyoming cities and counties and, thus, all jurisdictions within the State are expected to benefit from increased State tax revenues (WLSO, 2010).

7.1.2 Ross Project Costs

Potential costs include both the internal costs of the project borne by the Applicant and potential external costs that may be required by local public service providers in response to project activities, as well as non-monetary costs associated with the potential environmental impacts.

7.1.2.1 Internal Costs

All internal costs would be borne by the Applicant—that is, the direct financial costs of the construction, operation, aquifer restoration, and decommissioning of the proposed Ross Project. The primary internal costs would include:

- Capital costs associated with the Applicant's obtaining land and mineral rights as well as securing regulatory approvals including permits, licenses, and related environmental studies
- Capital costs of facility and wellfield construction
- Costs of facility and wellfield operation and maintenance
- Costs of aquifer restoration
- Costs of facility and wellfield decontamination, dismantling, and decommissioning
- Costs of site reclamation and restoration

The Applicant estimates that these internal costs would be approximately $136.7 million (Strata, 2011a). The actual, estimated decommissioning costs for the Ross Project would be determined prior to Project operation, and a surety arrangement equal to the estimated decommissioning costs would be made a condition of the NRC license. Each year, the decommissioning cost estimate would be reviewed by the NRC and Wyoming Department of Environmental Quality (WDEQ), and adjustments would be made as necessary.

7.1.2.2 External Costs

Land Use

During the Proposed Action, impacts to local land use would occur. Impacts would result from land disturbances during construction and decommissioning, grazing and access restrictions, and competition for access to mineral rights. Land use impacts during all phases of the Project would be SMALL. Access restrictions at the Ross Project area, however, would preclude the economic benefits from existing agricultural and grazing activities. If site access is assumed to be restricted across the entire Ross Project area—696 ha [1,721 ac]—and based upon a market value of products sold from crop and livestock sales in Crook County averaging $28 per acre in 2007 dollars (USDA, 2009), $48,188 in annual lost-agriculture sales would be estimated as the upper end of this potential loss, or $481,880 over the lifecycle of the Project. These losses would be offset by the compensation paid to the landowners, where the exact terms of the respective compensation is confidential.

Transportation

During the Proposed Action, the highest traffic volume would occur during the construction phase because of the relatively large workforce as well as the increased demand for materials and equipment at the Project area. The increased traffic is expected to be 400 passenger cars and 24 trucks per day, which, compared to 2010 levels, represents a significant traffic volume increase of approximately 400 percent on New Haven Road. Thus, construction-phase transportation impacts would be MODERATE to LARGE with respect to the traffic levels on local roads and the road surfaces, and SMALL with respect to traffic levels on I-90. All other phases would have less traffic related to commuting workers and, thus, the impacts would range from SMALL to LARGE. This traffic could result in more traffic accidents as well as wear and tear on road surfaces. Mitigation measures would be in place and would reduce the range of these impacts to SMALL to MODERATE.

Geology and Soils

Under the Proposed Action, potential impacts to geology and soils would occur due to the disturbance of 113 ha [280 ac] of the Ross Project area, or about 16 percent (Strata, 2011b). Other soil impacts would include the Applicant’s clearing of vegetation; stripping of topsoil; excavating, backfilling, and compacting soil; grading of the land; and trenching for utilities and pipelines. There is limited potential impact to geology because of the minor depth of disturbance associated with construction of the Ross Project. The potential impacts from soil loss would be minimized by proper design and operation of surface-runoff features and implementation of best management practices (BMPs). Impacts to geology and soils would be SMALL.

Water Resources

The Ross Project has the potential to impact surface water and ground water during each phase of its lifecycle.

Surface Water

Under the Proposed Action, surface-water-related impacts would include potentially increased sediment concentrations. Depending upon discharge rates and locations, impacts from the discharge of water generated during aquifer testing, during well installation and pipeline integrity testing, and during the dewatering of the facility areas inside of the containment barrier wall (CBW), surface-water impacts would be SMALL. Stream-channel disturbance, surface-water contamination, and surface-water consumptive use impacts would be SMALL. Impacts to surface water would also include the potential contamination of surface water by a spill or unintended release of process solutions, which could result in SMALL impacts with mitigation. Finally, reduced flows, in particular, the Little Missouri River would be a SMALL impact.

Ground Water

Under the Proposed Action, potential impacts to ground water are primarily from the consumptive use of ground water (i.e., removing more than is injected in), disposal of drilling fluids and cuttings during well drilling, and spills and leaks of fuels and lubricants from construction equipment. Impacts to shallow (i.e., near-surface) aquifers would be SMALL. The impacts to the ore-zone and surrounding aquifers regarding the quantity of water available would also be SMALL to MODERATE, while the potential impact of improperly abandoned drillholes, over-penetration of holes, or well integrity could result SMALL to MODERATE water-quality impacts in the event of an excursion in a Ross Project wellfield and SMALL elsewhere.

Ecology

Under the Proposed Action, potential environmental impacts to ecological resources, both flora and fauna, could occur during all phases of the Project; all impacts would be SMALL. The impacts to local vegetation would include:

- Removal of vegetation from the Ross Project area
- Modification of existing vegetative communities
- Loss of sensitive plants and habitats
- Potential spread of invasive species and noxious weed populations
- Reduction in wildlife habitat and forage productivity
- Increased risk of soil erosion and weed invasion

Impacts to terrestrial wildlife could include:

- Loss, alteration, or incremental fragmentation of habitat
- Displacement of and stresses on wildlife
- Direct and/or indirect mortalities

Aquatic species could be affected by:

- Disturbances of stream channels
- increases in suspended sediments
- Pollution from spills and leaks
- Reduction of habitat

These impacts would be mitigated by, for example, implementing the standard management practices required or suggested by the Wyoming Game and Fish Department (WGFD). All ecological resource impacts would be SMALL.

Air Quality

Under the Proposed Action, impacts from nonradiological particulate emissions would primarily result from fugitive road dust created by moving vehicles and mobile equipment throughout the Ross Project area and, to a far lesser extent, the processes and circuits implemented in the Central Processing Plant (CPP). Combustion-engine emissions from diesel-equipment operation would occur primarily during the construction, operation, and decommissioning phases. In general, however, uranium-recovery activities are not major air-emission sources. Air-quality impacts during all phases of the Ross Project would be SMALL.

Noise

Under the Proposed Action, there would be very temporary, but MODERATE, noise impacts for residences very near the Ross Project area; for residences, communities, or sensitive areas that are located more than approximately 300 m [1,000 ft] from specific noise-generating activities the impacts would be SMALL because noise levels quickly decrease with distance. These impacts would be the result of uranium-recovery activities and the associated traffic that would be associated with the Ross Project. During high truck-traffic events on New Haven Road during all phases of the Ross Project, residents living on those routes could occasionally be annoyed by the noise. There are no churches, schools, or community centers located less than 300 m [1,000 ft] from the Ross Project's boundary. Impacts to workers at the Project also would be SMALL because of the Applicant's compliance with OSHA noise regulations.

Historical, Cultural, and Paleontological Resources

The costs and benefits of the Ross Project related to historic, cultural, and paleontological resources will be determined once a complete inventory of these resources within the Ross Project area has been completed.

Visual and Scenic Resources

Under the Proposed Action, MODERATE, short-term impacts to the visual and scenic resources of the area during construction would occur, and SMALL longer-term impacts for the remainder of the Ross Project (see SEIS Section 4.10). Potential visual and scenic impacts would result from the surface disturbance and construction of the following: 1) wellfields (including drill rigs, header houses, wellhead covers, and roads; 2) the CPP; 3) surface impoundments; 4) the CBW; 5) secondary and tertiary access roads; 6) power lines; and 7) fencing. The nearest protected visual resource to the Ross Project is the Devils Tower National Monument, which is approximately 16 km [10 mi] east of the Ross Project. Although the Project itself would not be visible at the lower park portion of the Tower, climbers ascending to the top of the Tower may be able to see some of the Project's largest attributes as well as, in the night sky, the lights of the Project. The visual impacts from the Ross Project would be consistent with the U.S. Bureau of Land Management's (BLM's) VRM Class III designation (NRC, 2009).

The degradation of views of the nighttime sky in the surrounding vicinity of the Project area has been evaluated using the contingent valuation method (CVM) at four national parks (i.e., Yellowstone, Great Basin, Mesa Verde, and Chaco Canyon) during summer surveys in 2007 (Mitchell et al., 2008). These surveys were designed to quantify the willingness-to-pay (WTP) to reduce light pollution in these areas. Over 50 percent of respondents were willing to pay a positive amount to address light pollution. The average amount individuals would be willing to increase their Federal tax to reduce light pollution was estimated to be $39.37 per year per person. When the self-reported survey characteristics are reviewed, there is a positive correlation between the extent individuals are exposed to light pollution and their willingness to pay to reduce it. Hence, people in rural areas are generally less willing to pay to reduce light pollution. There are 11 residences within Ross Project area where visual-resource impacts were evaluated (see SEIS Section 4.10). Based on an average household size of 2.41 persons per household in Crook County (USCB, 2012), an estimated 27 persons could be affected by light from the Project, and the external costs associated with light pollution would be $1,063 per year or $10,630 over the lifecycle of the Ross Project.

Socioeconomics

Under the Proposed Action, the impacts of the Ross Project on the demand for community services are projected to be small (see SEIS Section 4.11.1.1). The Applicant is committed to hiring locally and, during peak construction-phase activities, it is projected only 52 additional residents are expected in the ROI (i.e., Crook and Campbell Counties). Lower demographic impacts occur in subsequent Project phases. Ross Project-related population increases would represent less than 0.1 percent of the 2010 population in the two-county ROI and, in general, existing community-service providers, such as local schools, health-service agencies, and police and fire-protection agencies, are not expected to be adversely affected by this level of increased demand for public services.

There would be an increased need, however, for emergency-response services. The Applicant has entered into a Memorandum of Understanding (MOU) with Crook County (Strata and Crook County, 2011) that states the Applicant would coordinate emergency-management, hazardous-materials management, and fire-suppression planning with Crook County's Homeland Security Director and Crook County's Fire Warden and Fire Zone Warden. The Applicant commits to maintaining the onsite personnel and equipment necessary to provide emergency services when environmental, safety, or health emergencies arise at the Ross Project. As such, these services would not represent a cost to local governments (Strata and Crook County, 2011).

The MOU also states the Applicant would:

- Provide electronic warning signs that would close county roads into the Ross Project area in the case of an emergency.
- Provide dust control for the existing and increased traffic as a result of the Ross Project, as necessary, and, as required by the WDEQ. This would include dust control over each one-quarter mile of county roads fronting the residences along any road designated by the County as an access road to the Ross Project, in order to minimize dust impacts on area residents beyond the Ross Project area.
- Maintain and repair damage caused by Applicant's trucks or contracted trucks as a result of their use, as dictated and regulated by Crook County (Strata and Crook County, 2011).

These measures would minimize any costs that would be borne by local jurisdictions and area residents.

Environmental Justice

Under the Proposed Action, no minority or low-income populations have been identified in the Ross Project area. Therefore, there are no disproportionately high and adverse impacts to minority and low-income populations by the Ross Project.

Public and Occupational Health and Safety

Under the Proposed Action, potential nonradiological and radiological impacts to the public's and workers' health and safety over the course of the Ross Project could include accidental chemical or radiological releases, chemical or byproduct liquid spills, particulate and gaseous emissions, vehicular and equipment accidents, worker injuries and illnesses, or fires. The Applicant proposes to minimize these potential impacts through rigorous worker training, facility and wellfield design, operational controls, and a series of emergency-response protocols.

An important factor in the assessment of risks to public health and safety is the proximity of potentially impacted populations. The nearest incorporated community to the Ross Site is Moorcroft, Wyoming, with an estimated population of less than 1,000; Moorcroft is located approximately 35 km [22 mi] south of the Ross Project area. Unincorporated Oshoto is adjacent to the Ross Project area, but it has a population of fewer than 50 persons. In addition, the quantities of materials that could be released, even through the air pathway, would be small and, as discussed in SEIS Section 4.7, would be dispersed and diluted. Workers involved in the response and cleanup of spills and leaks could receive MODERATE impacts; these would be mitigated by establishing standard operating procedures (SOPs) and training requirements. Thus, little to no risk would be borne to the offsite public, and these impacts would be considered SMALL.

Waste Management

Under the Proposed Action, both liquid and solid wastes would be generated during all phases of the Ross Project's lifecycle. Several major waste streams are identified in SEIS Section 4.14. At least four of these waste streams have to the potential to impact the local communities.

The disposal of liquid byproduct wastes would be accomplished by injection of these wastes into a confined aquifer. The regulatory-permitting process for this type of waste disposal would ensure that all mitigation measures to minimize related potential impacts would be taken. Ordinary solid wastes would include trash, spent materials, and broken equipment. Hazardous waste would represent a very small volume of spent reagents and other items such as batteries. Radioactive solid waste would consist of Ross Project equipment, process vessels, building components, and other items that could not be decontaminated and released as nonradioactive. Although all of these wastes would be disposed of at offsite waste-disposal facilities, the relatively small volume of such wastes would have little impact on the respective disposal facilities' ultimate capacity. Waste management impacts during all phases of the Ross Project would be SMALL.

7.1.3 Findings and Conclusions

Implementation of the Proposed Action would have a SMALL to MODERATE socioeconomic impact on the ROI, with MODERATE impacts associated with the benefits of the additional tax revenue projected to accrue to Crook County. Regional benefits would include increased employment, economic activity, and tax revenues in the region and the State of Wyoming. Because the Applicant is committed to hiring locally, population increases and the subsequent need for additional public services is projected to be negligible. Access restrictions to the Ross Project area would result in the loss of some economic activities, but this loss is expected to be offset to a degree by the Applicant's compensation to the affected landowners. A limited number of residents would also be affected by light pollution from the Ross Project. However, overall, the economic benefits of the Proposed Action would be greater than the associated costs.

7.2 Alternative 2: No Action

Under the No-Action Alternative, the NRC would not issue the Applicant a license to construct, operate, restore the aquifer, and decommission the proposed Ross Project. Area residents would benefit from some limited preconstruction activities, but no longer-term economic benefits would accrue to area residents, local jurisdictions, or the State. Similarly, there would be no potential costs borne by nearby jurisdictions and residents.

7.3 Alternative 3: North Ross Project

Construction, operation, aquifer restoration, and decommissioning of the North Ross Project are not expected to result in any significant differences in this cost-benefit analysis. Overall land use impacts would be generally the same as for the Proposed Action, although impacts to dry-land crop agriculture would be lower, while impacts to grazing activities would be greater. Small changes in traffic patterns on roads to and in the Ross Project Area would result in reduced traffic volumes on New Haven Road that would be offset by increased traffic on other roads. These changing traffic patterns would slightly increase noise and air quality impacts, but the impacts would be offset by fewer affected residents. Impacts to other resources areas also are generally the same as for the Proposed Action. Thus, the major benefits and costs described for the Proposed Action would accrue similarly were the facility to be constructed and operated at the north site.

7.4 References

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8 SUMMARY OF ENVIRONMENTAL CONSEQUENCES

The environmental consequences of the Proposed Action, the Ross Project, and Alternative 3, the North Ross Project, are summarized next in Table 8.1.

Table 8.1
Summary of Environmental Consequences of the Proposed Action and Alternatives

	Unavoidable Adverse Environmental Impacts	Irreversible and Irretrievable Commitment of Resources	Short-Term Impacts and Uses of the Environment	Long-Term Impacts and the Maintenance and Enhancement of Productivity
LAND USE				
Alternative 1: Proposed Action Ross Project (See SEIS Section 4.2.1.)	There would be SMALL unavoidable adverse impacts on land use over the lifecycle of the Ross Project because certain areas of the Project area would be fenced during the Project's construction, operation, aquifer restoration, and decommissioning. The area disturbed, however, is small—113 hectares (ha) [280 acres (ac)]. At the end of the Project, after facility decommissioning and site restoration have been fully accomplished, the former land uses of the Ross Project area would be restored.	There would be no irreversible or irretrievable impacts to land use in the area as a result of the Proposed Action. All land would be restored to its baseline uses post-Ross Project. Access roads would be removed, or they would be left as desired by the respective landowner(s).	There would be short-term land-use impacts during the Proposed Action, predominantly due to a decrease in the total area available for livestock grazing.	There would be no long-term impacts on land use within the Ross Project area. The land would be restored to its pre-licensing baseline and former land uses would be possible after decommissioning of the Project and the site's restoration.
Alternative 3: North Ross Project (See SEIS Section 4.2.3.)	Approximately the same number of acres would be taken out from service during Alternative 3. The area that would be disturbed would still be small. However, some livestock grazing could be diminished during the lifecycle of Alternative 3. However, as above, after complete facility decommissioning and site restoration have been accomplished, the former land use would be restored.	There would be no irreversible or irretrievable impacts to land use in the area as a result of Alternative 3. All land would be restored to its baseline uses.	There would be short-term impacts to land use in Alternative 3. The total area available for livestock grazing would be temporarily reduced.	There would be no long-term impacts on the land use of the area of Alternative 3. As above, the land would be restored and the former pre-licensing land use would be re-established after the decommissioning of the Alternative 3.

Table 8.1
Summary of Environmental Consequences of the Proposed Action and Alternatives (Cont.)

	Unavoidable Adverse Environmental Impacts	Irreversible and Irretrievable Commitment of Resources	Short-Term Impacts and Uses of the Environment	Long-Term Impacts and the Maintenance and Enhancement of Productivity
TRANSPORTATION				
Alternative 1: Proposed Action Ross Project **(See SEIS Section 4.3.1.)**	During the four phases of the Proposed Action, the unavoidable impacts to transportation, which would be related specifically to traffic volumes, would range from SMALL to LARGE. Because the Ross Project is located in a rural area of Wyoming, where traffic is sparse, the increase in traffic as a result of the Proposed Action could create SMALL to LARGE impacts. However, with the mitigation measures the Applicant has proposed, during all phases of the Ross Project, transportation impacts would be SMALL to MODERATE.	There would be no long-term irreversible or irretrievable environmental impacts from increases in transportation by the Proposed Action. Once the Ross Project has been decommissioned and the site restored, all traffic impacts of the Proposed Action would cease as all related traffic would be zero.	Transportation impacts to the vicinity of the Proposed Action would be SMALL to MODERATE, with mitigation. These impacts would include increased traffic counts and a slightly higher probability of vehicular accidents. All of these short-term impacts would cease after the decommissioning of the Ross Project.	The long-term impacts of the Proposed Action with respect to transportation resources would be enhanced road quality. During the Ross Project, the Applicant would ensure that the roads leading to and from the Project would be well built and maintained. Although the maintenance that would be provided by the Applicant would cease after the Proposed Action is complete, the remaining roads, however, would be of better quality than they are currently.
Alternative 3: North Ross Project **(See SEIS Section 4.3.3.)**	The construction and operation of the Central Processing Plant (CPP) at the north site would, in general, have the same transportation impacts as the Proposed Action, and these impacts would be SMALL to LARGE. With mitigation measures, the impacts would be SMALL to MODERATE.	There would be no irreversible impacts to land use in the area as a result of Alternative 3. All transportation impacts would cease at the conclusion of Alternative 3. Access roads would be removed, or they would be left as desired by the respective landowner(s).	There would also be short-term impacts to transportation in Alternative 3, and they would be the same as for the Proposed Action.	The long-term impacts of Alternative 3 would be the same as those in the Proposed Action, where roads would be improved by the Applicant and these improvements would remain after Alternative 3 was decommissioned and its site restored.

Table 8.1
Summary of Environmental Consequences of the Proposed Action and Alternatives (Cont.)

	Unavoidable Adverse Environmental Impacts	Irreversible and Irretrievable Commitment of Resources	Short-Term Impacts and Uses of the Environment	Long-Term Impacts and the Maintenance and Enhancement of Productivity
GEOLOGY AND SOILS				
Alternative 1: Proposed Action Ross Project **(See SEIS Section 4.4.1.)**	There would be SMALL unavoidable adverse potential environmental impacts to the geology and soils at the Proposed Action. Wind and water erosion are possible, but the Applicant would mitigate the potential for erosion with best management practices (BMPs) specifically related to erosion. (Fugitive dust is discussed under “Air Quality” in this Table.) There would be few geology and soils impacts during the Proposed Action.	There would be no irreversible or irretrievable commitment of geology or soil resources during the Proposed Action. No permanent changes would occur to the overall geology and soils of the Ross Project.	There would be some short-term potential impacts to soils under the Proposed Action, such as loss due to erosion. With the mitigation measures proposed by the Applicant, however, these potential impacts are unlikely, even over the short term.	There would be no long-term impacts to geology or soils during the Proposed Action at the Ross Project.
Alternative 3: North Ross Project **(See SEIS Section 4.4.3.)**	Alternative 3, as in the Proposed Action, would have the potential for wind or water erosion. With mitigation, however, little erosion would be expected. Greater soil disturbance for construction of the surface impoundments for Alternative 3 would be expected because of the site-specific topographic conditions. There would be SMALL impacts to the geology and soils at the Ross Project area.	There would be no irreversible or irretrievable impacts to geology or soils during Alternative 3.	There would be small impacts related to the potential for eroding soils during Alternative 3; these would be mitigated and, consequently, SMALL.	There would be no long-term impacts to geology or soils in Alternative 3.

Table 8.1
Summary of Environmental Consequences of the Proposed Action and Alternatives (Cont.)

	Unavoidable Adverse Environmental Impacts	Irreversible and Irretrievable Commitment of Resources	Short-Term Impacts and Uses of the Environment	Long-Term Impacts and the Maintenance and Enhancement of Productivity
WATER RESOURCES: SURFACE WATER				
Alternative 1: Proposed Action Ross Project (See SEIS Section 4.5.1.)	There would be SMALL unavoidable adverse impacts on surface water over the lifecycle of the Ross Project. Surface water would be potentially impacted by sediment from stormwater run-off and crossing water features with roads and pipelines. The moisture conditions of wetlands situated along the Little Missouri River and adjacent to the Oshoto Reservoir would potentially be impacted. Accidental leaks, spills, and other releases of fluids would potentially impact surface water quality. With mitigation, however, little sedimentation would be expected and accidental releases would be contained.	There would be no irreversible or irretrievable impacts to surface water by the Proposed Action. Small amounts of surface water would be used for construction activities and dust control, but this water would be replaced by normal precipitation.	There would be some short-term potential impacts to surface water under the Proposed Action, such as increased sedimentation. With the mitigation measures proposed by the Applicant, however, these potential impacts are unlikely, even over the short term.	There would be no long-term impacts to surface water during the Proposed Action at the Ross Project area.
Alternative 3: North Ross Project (See SEIS Section 4.5.1.)	The construction and operation of the CPP at the north site in Alternative 3 would, in general, have the same surface water impacts as the Proposed Action; however the mitigation measures required to protect the two ephemeral drainages and the steeper land slopes at the North Ross Project would involve more engineering. With mitigation measures, the impacts would be SMALL.	As with the Proposed Action, there would be no irreversible or irretrievable impacts to surface water during Alternative 3.	The potential short-term impacts to surface water during Alternative 3 would be the same as for the Proposed Action.	There would be no long-term impacts to surface water at the North Ross Project under Alternative 3.

Table 8.1
Summary of Environmental Consequences of the Proposed Action and Alternatives (Cont.)

	Unavoidable Adverse Environmental Impacts	Irreversible and Irretrievable Commitment of Resources	Short-Term Impacts and Uses of the Environment	Long-Term Impacts and the Maintenance and Enhancement of Productivity
WATER RESOURCES: GROUND WATER				
Alternative 1: Proposed Action Ross Project **(See SEIS Section 4.5.1.)**	There would be SMALL unavoidable adverse impacts to water quality and MODERATE unavoidable adverse impacts to water quantity on ground-water resources over the lifecycle of the Ross Project. Aquifers would be impacted by water withdrawal and injection of lixiviant. Lowering of water levels would be seen within and outside the Project area. The water quality of the aquifers outside and below the exempted aquifer would temporarily be impacted if excursions of lixiviant were to occur. Ground water above the exempted aquifer would potentially by impacted by leaks from wells and releases at the surface. With mitigation, however, little potential for excursions, leaks and accidental releases would be minimized. There would be SMALL to MODERATE impacts to the ground water quantity and SMALL impacts to ground water quality at the Ross Project area.	There would be no irreversible or irretrievable impacts to ground water from the Proposed Action. The lower ground water levels in the ore-zone aquifer and the aquifer overlying the ore zone would be replaced by normal recharge over time. Excursions would be remediated by pumping out contaminated water. The water quality of the exempted aquifer would consequently be restored.	Lowering of water levels would be a short-term impact to ground water from the Proposed Action. Based upon historical experience with uranium-recovery projects, excursions of lixiviant often occur and create short-term impacts to water quality. The mitigation measures proposed by the Applicant and required by permit and license conditions, such as water-management actions to minimize water usage from the aquifers, tests to ensure integrity of the wells, and early detection of excursions short-term impacts would reduce these impacts at the Ross Project.	There would be no long-term impacts to ground water by the Proposed Action. The water levels would rebound through normal aquifer recharge and restoration activities would return the water-quality to aquifer-restoration target values.

Table 8.1
Summary of Environmental Consequences of the Proposed Action and Alternatives (Cont.)

	Unavoidable Adverse Environmental Impacts	Irreversible and Irretrievable Commitment of Resources	Short-Term Impacts and Uses of the Environment	Long-Term Impacts and the Maintenance and Enhancement of Productivity
WATER RESOURCES: GROUND WATER (*Continued*)				
Alternative 3: North Ross Project **(See SEIS Section 4.5.3.)**	The construction and operation of the CPP at the north site would have the same mitigated impacts to ground water as the Proposed Action except, during Alternative 3, fewer mitigation measures to minimize the potential impacts to the shallow, unconfined aquifer from spills and leaks of byproduct liquid waste from the impoundments would be required. The greater depth to the shallow aquifer below the impoundments at the north site would eliminate the need for the containment barrier wall to prevent ground-water flow in the area below the impoundments as in the Proposed Action. Mitigation of the potential for leaks from the impoundments at the north site would rely upon leak detection and monitoring systems as well as remediation if contaminants reached the ground water.	As described for the Proposed Action, there would be no irreversible or irretrievable impacts to ground water under Alternative 3.	The short-term impacts during Alternative 3 would be the same as described for the Proposed Action.	There would be no long-term impacts to ground water at the North Ross Project under Alternative 3.

Table 8.1
Summary of Environmental Consequences of the Proposed Action and Alternatives (Cont.)

	Unavoidable Adverse Environmental Impacts	Irreversible and Irretrievable Commitment of Resources	Short-Term Impacts and Uses of the Environment	Long-Term Impacts and the Maintenance and Enhancement of Productivity
ECOLOGY				
Alternative 1: Proposed Action Ross Project **(See SEIS Section 4.6.1.)**	There would be SMALL unavoidable impacts related to the ecology of the Proposed Action. Some wildlife could be displaced during Project activities, especially during construction and decommissioning. The areas where human activities would be conducted could interrupt wildlife, bird, and protected species that presently occur on the site. In addition, some vegetative impacts could occur as the land is used for uranium recovery. However, once facility decommissioning and site restoration have been completed all of these impacts would diminish, or baseline conditions would be re-established, and the ecology of the Project area would be restored over time.	There would be no irreversible or irretrievable commitment of ecological resources during the Proposed Action. There are no Greater-sage-grouse leks on the Ross Project itself. If one or more were to become present, the Applicant would be required to alter its activities, as appropriate, at the Ross Project.	There would be some short-term impacts to the ecology of the Proposed Action which would include the disruption of some species of vegetation as well as the potential for wildlife, including birds, to move elsewhere, away from Ross Project activities and noise. These impacts would cease when the decommissioning and reclamation of the Ross Project area are complete and the local habitat is restored.	There would be no long-term impacts to the area of the Ross Project. At the time of its closure, a decommissioning plan would be required, and this plan would require restoration of the Project area to its former baseline conditions.
Alternative 3: North Ross Project **(See SEIS Section 4.6.3.)**	Alternative 3 would have the potential for the same impacts to the local ecology as the Proposed Action. These impacts, however, would be SMALL.	There would be no irreversible or irretrievable impacts to the local ecology during Alternative 3.	There would be small, short-term impacts related to the disturbance of native vegetation and nearby wildlife during Alternative 3; these would be SMALL and would be the same as the Proposed Action.	There would be no long-term impacts to ecology under Alternative 3.

Table 8.1
Summary of Environmental Consequences of the Proposed Action and Alternatives (Cont.)

	Unavoidable Adverse Environmental Impacts	Irreversible and Irretrievable Commitment of Resources	Short-Term Impacts and Uses of the Environment	Long-Term Impacts and the Maintenance and Enhancement of Productivity
AIR QUALITY				
Alternative 1: Proposed Action Ross Project **(See SEIS Section 4.7.1.)**	There would be unavoidable adverse effects to local air quality due to the emission of combustion gases and fugitive dusts during all of the phases of the Proposed Action. These impacts would be SMALL. Fugitive dusts would become airborne during construction activities (e.g., road construction and site clearing and contouring) as well as during vehicular use to, from, and on the Project area. The Applicant would have an Air Quality Permit, however, that would require air emissions to be mitigated so that emissions would be kept to a minimum.	No permanent changes would occur to the overall quality of air at or near the Ross Project.	There would be SMALL short-term potential impacts to air quality under the Proposed Action. Gaseous and fugitive-dust emissions would be generated during all phases of the Ross Project. With the mitigation measures proposed by the Applicant, and those required by its Air Quality Permit, however, these potential impacts would be short term.	There would be no long-term impacts to air quality at the Ross Project. Once the Proposed Action has been decommissioned and the Project area reclaimed and restored, all air-quality impacts would cease.
Alternative 3: North Ross Project **(See SEIS Section 4.7.3.)**	Under Alternative 3, the same air-quality impacts would occur as during the Proposed Action. Because the CPP would be located such that gravel-road surfaces would be used slightly more often, there could be slightly more fugitive dust generated under Alternative 3.	No permanent changes would occur to the overall quality of air at or near the North Ross Project.	As for the Proposed Action, Alternative 3 would generate gaseous and fugitive-dust emissions throughout its lifecycle. But these impacts would also be SMALL.	There would be no long-term impacts to air quality as a result of Alternative 3. Once facility at the north site has been decommissioned and the Project area reclaimed and restored, all air-quality impacts would cease.

Table 8.1
Summary of Environmental Consequences of the Proposed Action and Alternatives (Cont.)

	Unavoidable Adverse Environmental Impacts	Irreversible and Irretrievable Commitment of Resources	Short-Term Impacts and Uses of the Environment	Long-Term Impacts and the Maintenance and Enhancement of Productivity
NOISE				
Alternative 1: Proposed Action Ross Project (See SEIS Section 4.8.1.)	There would be would be SMALL to MODERATE unavoidable adverse noise impacts during the Proposed Action. Because the Ross Project has several residences located near its boundaries, the noise generated during the Project's lifecycle would be MODERATE to those nearest receptors. In addition, due to supply deliveries, commuter traffic, and shipments from the Project, there would be increased vehicular noise. The four phases of the south Ross Project facility, including the CPP, surface impoundments, and other structures as well as the installation of wells would cause noise impacts that could not entirely be mitigated for nearby residents; however, the noise impacts would quickly diminish at greater distances from the Ross Project area.	There would be no long-term permanent noise impacts from the Proposed Action. Once the Ross Project has been decommissioned and the site restored, all Project-related noise would cease.	Short-term noise impacts in the vicinity of the Proposed Action would be SMALL to MODERATE. These impacts would include increased construction noise as well as increased vehicular noise. All such impacts, however, would cease after facility decommissioning and site restoration activities are complete.	There would be no long-term impacts by the Proposed Action with respect to noise.
Alternative 3: North Ross Project (See SEIS Section 4.8.3.)	During Alternative 3, there would be SMALL to MODERATE unavoidable adverse impacts with respect to noise. These impacts would be the same as in the Proposed Action, except some noise impacts would be diminished because construction and decommissioning activities at the north site would be a greater distance to the nearest residence.	There would be no long-term permanent noise impacts from Alternative 3. Once the north Ross Project has been decommissioned and the site restored, all Project-related noise would cease.	Short-term noise impacts in the vicinity of Alternative 3 would be SMALL to MODERATE. These impacts would include increased construction noise as well as increased vehicular noise. All such impacts, however, would cease after facility decommissioning and site restoration activities are complete.	There would be no long-term impacts by Alternative 3 with respect to noise.

Table 8.1
Summary of Environmental Consequences of the Proposed Action and Alternatives (Cont.)

	Unavoidable Adverse Environmental Impacts	Irreversible and Irretrievable Commitment of Resources	Short-Term Impacts and Uses of the Environment	Long-Term Impacts and the Maintenance and Enhancement of Productivity
HISTORICAL, CULTURAL, AND PALEONTOLOGICAL RESOURCES				
Alternative 1: Proposed Action Ross Project **(See SEIS Section 4.9.1.)** **Alternative 3: North Ross Project** **(See SEIS Section 4.9.3.)**	Impacts on historic and cultural resources during the ISR construction phase would be SMALL to LARGE. To mitigate the impact, NRC, BLM, WY SHPO, Tribes, and the Applicant will develop and execute an agreement that would formalize treatment plans for adversely impacted resources during construction. If other NRHP-eligible sites cannot be avoided then treatment plans would be developed. If other historic and cultural resources are encountered during the ISR lifecycle, the Applicant would notify the appropriate authorities per an unexpected discovery plan.	If archaeological and historic sites cannot be avoided, or the impacts to these sites cannot be mitigated, this could result in an irreversible and irretrievable loss of cultural resources.	There would be a SMALL to LARGE impact on historic and cultural resources during the ISR construction phase. The development of an agreement between NRC, BLM, WY SHPO, Tribes, and the Applicant would address adverse impacts to cultural and historic sites and historic properties of traditional religious and cultural importance to Native American tribes. If any unidentified historic or cultural resources are encountered, work would stop and appropriate authorities would be notified per the unexpected discovery plan.	If potential impacts from implementation of the proposed action are not mitigated, then long-term impacts to cultural and historic resources would result.

Table 8.1
Summary of Environmental Consequences of the Proposed Action and Alternatives (Cont.)

	Unavoidable Adverse Environmental Impacts	Irreversible and Irretrievable Commitment of Resources	Short-Term Impacts and Uses of the Environment	Long-Term Impacts and the Maintenance and Enhancement of Productivity
VISUAL AND SCENIC RESOURCES				
Alternative 1: Proposed Action Ross Project **(See SEIS Section 4.10.1.)**	There would be SMALL unavoidable impacts related to the visual and scenic resources at the Proposed Action. During the construction and decommissioning phases, in particular, earth-movement activities could be seen by a few of the nearby residents, who could experience MODERATE impacts. The lights of the Project could also be seen by some of the nearest neighbors. There would be many mitigation measures related to the lights of the Ross Project which would be implemented by the Applicant to diminish as much as possible the light emanating from the Proposed Action.	There would be no irreversible or irretrievable commitment of visual or scenic resources caused by the Proposed Action. All visual-resource impacts would be eliminated upon the Ross Project's facility decommissioning and site restoration activities. These activities would include restoring the baseline contours of the Ross Project area.	There would be some short-term impacts to the visual resources at the Proposed Action. These would include changes to the topography of the area; the presence of man-made structures; and light during nighttime hours. These impacts would cease when the decommissioning and reclamation of the Ross Project area are complete, when the baseline topography is restored and all lights are removed.	There would be no long-term impacts to the visual and scenic resources of the Ross Project area. At the time of the Ross Project's decommissioning, a decommissioning plan would be implemented, and this plan would require the restoration of the Project area to its former baseline conditions.
Alternative 3: North Ross Project **(See SEIS Section 4.10.3.)**	Alternative 3 would have the potential for visual-resource impacts as the Proposed Action. These SMALL impacts would be even less than those of the Ross Project, because the natural topography of the north area would shield construction and operation activities related to the uranium-recovery facility. Thus, the closest residences' views would be less impacted as would their experience of light in the nighttime skies.	There would be no irreversible or irretrievable impacts to the visual and scenic resources caused by Alternative 3.	There would be small, short-term impacts related to the disturbance of native vegetation and nearby wildlife during Alternative 3; these would be SMALL and would be the same as the Proposed Action.	There would be no long-term impacts to ecology in Alternative 3.

Table 8.1
Summary of Environmental Consequences of the Proposed Action and Alternatives (Cont.)

	Unavoidable Adverse Environmental Impacts	Irreversible and Irretrievable Commitment of Resources	Short-Term Impacts and Uses of the Environment	Long-Term Impacts and the Maintenance and Enhancement of Productivity
SOCIOECONOMICS				
Alternative 1: Proposed Action Ross Project **(See SEIS Section 4.11.1.)**	There would be SMALL unavoidable impacts related to the socioeconomics at the Proposed Action. These impacts, however, would be related to the increased revenues that local jurisdictions would collect related taxes on the Ross Project. Other socioeconomic factors such as impacts to employment, income, demographics, housing, and education as well as demand for social and health services would be SMALL, while the impacts relate to local tax revenues would be MODERATE during the construction and operation phases of the Ross Project.	There would be no irreversible or irretrievable commitment of socioeconomic resources during the Proposed Action. Socioeconomic impacts would be diminished upon the Ross Project's decommissioning. For example, the increased need for housing, although SMALL, would be eliminated after the Ross Project terminates.	There would be some short-term impacts to socioeconomic resources by the Proposed Action. These would include SMALL to MODERATE potential changes to local employment, income, demographics, housing, and education as well as demand for social and health services. All tax payments would also be eliminated at the conclusion of the Ross Project.	There would be no long-term impacts to socioeconomic resources by the Ross Project area. After the Ross Project's decommissioning, any increases that would have occurred in the employment, income, demographics, housing, and education sectors would have integrated and every worker would be able to relocate as s/he wishes. The demand for social and health services would be eliminated as would all tax payments in the finance sector.
Alternative 3: North Ross Project **(See SEIS Section 4.11.3.)**	There would be the same SMALL to MODERATE socioeconomic impacts to the area surrounding Alternative 3. As the socioeconomic variables evaluated for this SEIS do not depend upon the geography of the Ross Project, the North Ross Project would accrue the same impacts as the Proposed Action.	There would be no irreversible or irretrievable commitment of socioeconomic resources during Alternative 3 as for the Proposed Action.	There would be some short-term impacts to socioeconomic resources caused by Alternative 3. These would include the same SMALL potential changes to local employment, income, demographics, housing, and education as well as demand for social and health services and MODERATE impacts to local jurisdictions.	There would be no long-term impacts to socioeconomic resources as a result of Alternative 3.

Table 8.1
Summary of Environmental Consequences of the Proposed Action and Alternatives (Cont.)

	Unavoidable Adverse Environmental Impacts	Irreversible and Irretrievable Commitment of Resources	Short-Term Impacts and Uses of the Environment	Long-Term Impacts and the Maintenance and Enhancement of Productivity
ENVIRONMENTAL JUSTICE				
Alternative 1: Proposed Action Ross Project (See SEIS Section 4.12.) **Alternative 3: North Ross Project** (See SEIS Section 4.12.)	There are no minority and low-income populations located within four miles of the Ross Project area. Consequently, an environmental justice-analysis has not been performed for this Proposed Action.			
PUBLIC AND OCCUPATIONAL HEALTH AND SAFETY				
Alternative 1: Proposed Action Ross Project (See SEIS Section 4.13.1.) **Alternative 3: North Ross Project** (See SEIS Section 4.13.3.)	There would be a SMALL impact on public and occupational health. Construction and decommissioning would generate fugitive dust emissions that would not result in a significant dose to the public or site workers. The emissions from construction equipment would be of short duration and would readily disperse into the atmosphere.	Not applicable	There would be a SMALL impact from radiological exposure. Dose calculations under normal operations showed that the highest potential dose within the proposed project area is 5 percent of the 1 mSv [100 mrem] per year public dose limit specified in NRC regulations. The radiological impacts from accidents would be SMALL for workers if procedures to deal with accident scenarios are followed, and SMALL for the public because of the facility's remote location. The nonradiological public and occupational health impacts from normal operations, accidents, and chemical exposures would be SMALL if handling procedures are followed.	There will be no long-term impact to public and occupational health following license termination.

Table 8.1
Summary of Environmental Consequences of the Proposed Action and Alternatives (Cont.)

	Unavoidable Adverse Environmental Impacts	Irreversible and Irretrievable Commitment of Resources	Short-Term Impacts and Uses of the Environment	Long-Term Impacts and the Maintenance and Enhancement of Productivity
WASTE MANAGEMENT				
Alternative 1: Proposed Action Ross Project **(See SEIS Section 4.14.1.)**	There would be SMALL unavoidable adverse impacts as a result of waste management at the Proposed Action. The management of all waste streams (ordinary solid and domestic wastes, solid and liquid hazardous wastes, and all byproduct wastes) would be SMALL during all phases of the Ross Project. Many of the waste streams would be shipped off site to regulated (i.e., permitted or licensed as appropriate) facilities, which have undergone careful scrutiny by the respective regulatory agencies. In addition, discharge of small amounts of excess permeate into the Class I deep-injection wells at the Project would comply with Underground Injection Control (UIC) Permit from the Wyoming Department of Environmental Quality (WDEQ).	There would be no irreversible or irretrievable resources committed to waste management, except for the respective liquid wastes which would be injected into the Deadwood and Flathead Formations approximately 8,000 feet below the surface. However, these aquifers are not potable and have not been identified as a source of oil and gas resources, the injection of waste would not impact the aquifer's future use.	There would be few short-term impacts due to waste management at the Proposed Action. These short-term impacts, such as to transportation as well as public and occupational health and safety, which are described in those respective resource areas, would cease when waste is no longer generated or managed at the Ross Project. In addition, during the operation of the Proposed Action, there would be two double-lined surface impoundments over a 6.5 ha [16 ac] area; the presence of these impoundments could have impacts to wildlife and birds. However, control features, such as an avian deterrent system would be operated throughout the Ross Project. These surface impoundments would be completely removed during facility decommissioning.	All Ross Project wastes would be either shipped offsite by the conclusion of the decommissioning phase, or would be disposed of in the Class I deep-disposal wells. During all phases of the Proposed Action permanent disposal or storage of both radiological and nonradiological wastes would represent a long-term, but SMALL, impact on the productivity of the land allocated for these activities.
Alternative 3: North Ross Project **(See SEIS Section 4.14.3.)**	There could be SMALL unavoidable waste-management impacts at Alternative 3. These would be the same as those indicated above for the Proposed Action. The volume of demolition waste could be somewhat less than the Proposed Action's, because the containment barrier wall would not have been constructed.	This Alternative would also employ a deep-disposal well, so that the same commitment of the Deadwood and Flathead aquifer would occur.	The short-term impacts of Alternative 3's management of wastes would be the same as those for the Proposed Action.	The long-term impacts of Alternative 3's management of wastes would be the same as those for the Proposed Action.

9 LIST OF PREPARERS

This section documents all individuals who were involved with the preparation of this Draft Supplemental Environmental Impact Statement (DSEIS). Contributors include staff from the NRC and its consultants. Each individual's responsibilities and affiliation are as follows.

9.1 U.S. Nuclear Regulatory Commission Contributors

Johari Moore: SEIS Project Manager
M.S., Nuclear Engineering and Radiological Science, University of Michigan, 2005
B.S., Physics, Florida A & M University, 2003
Years of Experience: 7

Ashley Waldron: SEIS Co-Project Manager
B.S., Biology, Frostburg State University, 2009
Years of Experience: 3

John Saxton: Safety Project Manager
Connecticut Licensed Environmental Professional, 2001
M.S., Geology, University of New Mexico, 1989
B.S., Geological Engineering, Colorado School of Mines, 1983
Years of Experience: 25

9.2 Attenuation Environmental Company Team

Doris Minor: Project Manager and Task Co-Manager
Attenuation Environmental Company
Radiological Public and Occupational Health and Safety/Solid and Radioactive Waste Management
B.A., English Literature, University of Washington, 1978
M.S.E., (Nuclear) Engineering, University of Washington, 1984
Years of Experience: 28

Dr. Kathryn Johnson: Assistant Project Manager and Task Co-Manager
Attenuation Environmental Company
Geochemistry/Geology/Water Resources/Liquid Waste Management/Facility Design and Operation
Ph.D., Geology, South Dakota School of Mines & Technology, 1986
M.S., Chemistry, Iowa State University, 1977
B.S., Chemistry and Mathematics, Black Hills State College, 1975

Jerry Boese
Ross & Associates Environmental Consulting Ltd., dba Ross Strategic
Comment Responses
M.P.A., John F. Kennedy School of Government, Harvard University, 1989
B.S., Biology and Economics, Yale University, 1975
Years of Experience: 32

9.2 Attenuation Environmental Company Team (*Continued*)

Dr. Tony Burgess
Attenuation Environmental Company
Ground-Water Resources
Ph.D., Geology (Engineering Geology and Hydrogeology), University of Durham, United Kingdom, 1970
B.Sc., Geology University of Durham, United Kingdom, 1966
Years of Experience: 43

Dr. Cheryl Chapman, P.E.
RESPEC Consulting and Services Inc.
Tribal Coordination and Consultation
Ph.D. in Biological Sciences, South Dakota State University, Brookings, South Dakota, 2007
B.S., Civil and Environmental Engineering, South Dakota School of Mines & Technology, Rapid City, South Dakota, 1978
B.S., Mathematics, South Dakota School of Mines & Technology, Rapid City, South Dakota, 1978
Years of Experience: 32

Lauren Evans, P.E.
Pinyon Environmental Engineering Resources Inc.
Land Use/Transportation/Ecological Resources/Meteorology
B.S., Geological Engineering, Colorado School of Mines, 1982
Years of Experience: 30

Linn Gould
Erda Environmental Services Inc.
Environmental Justice/Cumulative Impacts
M.P.H., University of Washington, 2003
M.S., Soil Science, University of Wisconsin-Madison, 1988
B.A., Geology, Smith College, 1980
Years of Experience: 25

Dave Heffner, P.E.
Aspect Consulting L.L.C.
Chemical Engineering
M.S., Chemical Engineering, Georgia Institute of Technology, 1981
B.S., Environmental Engineering, Rensselaer Polytechnic Institute, 1979
Years of Experience: 30

Mary Kenner
RESPEC Consulting and Services Inc.
Tribal Coordination and Consultation
B.S., Interdisciplinary Science, South Dakota School of Mines & Technology, 1998
Years of Experience: 28

9.2 Attenuation Environmental Company Team (*Continued*)

Scott Kindred, P.E.
Aspect Consulting L.L.C.
Ground-Water and Surface-Water Resources/Geology/Soils
M.S., Civil Engineering, Massachusetts Institute of Technology, 1987
B.S., Geology, Brown University, 1983
Years of Experience: 20

Charles McClendon
The Delphi Groupe, Inc.
Radiological/Mining/Industrial Hygiene/RSO/NEPA
B.S., Civil (Mining) Engineering, Colorado School of Mines, 1976
M.B.A., Nova University, Dade County, Florida 1985
Years of Experience: 35

Dave McCormack
Aspect Consulting L.L.C.
Geology/Soils
M.S., Geology, Northern Arizona State University, 1989
B.S., Geological Sciences, University of Washington, 1983
Years of Experience: 23

Christian J. Miss
SWCA Environmental Consultants
Historical, Cultural, and Paleontological Resources/Tribal Consultation
B.A., Biology, Case Western Reserve University, 1970
M.A., Anthropology, Idaho State University, 1978
Years of Experience: 40

Jessie Piper
SWCA Environmental Consultants
Historical, Cultural, and Paleontological Resources/Tribal Consultation
B.A., Anthropology, University of Arizona, 1989
M.A., Anthropology, University of Arizona, 1992
Years of Experience: 20

Debby Reber
SWCA Environmental Consultants
Visual Resources
B.A., Natural Resource Management, University of California, Chico, 1984
Years of Experience: 15

9.2 Attenuation Environmental Company Team (*Continued*)

Owen Reese, P.E.
Aspect Consulting L.L.C.
Surface-Water Resources
M.S., Civil Engineering, University of Washington, 1997
B.S., Civil Engineering, University of Washington, 1996
Years of Experience: 15

Barbara Trenary
Attenuation Environmental Company
Air Quality/Noise/Non-Radiological Public and Occupational Health and Safety
B.S., Environmental Sciences, Industrial Hygiene, Colorado State University, 1979
Years of Experience: 33

Jeff Vitucci
Robert D Niehaus Inc.
Socioeconomics/Cost-Benefit Analysis
M.A., Economics, University of California, Santa Barbara, 1978
B.A., Environmental Studies, San Jose State University, 1974
Years of Experience: 34

Elly Weber
Pinyon Environmental Engineering Resources Inc.
Ecological Resources
M.S., Environmental Science, Texas Christian University, 2004
B.S., Biology, Texas Christian University, 2001
Years of Experience: 5

Richard Weinman
Attenuation Environmental Company: Assistant Project Manager
NEPA Analysis/Regulatory Compliance/Land Use Planning
B.A., English, New York University, 1965
M.A., English, Brandeis University, 1966
J.D., Law, University of Puget Sound (Seattle University) School of Law, 1978
Years of Experience: 33

10 DISTRIBUTION LIST

The NRC is providing copies of this Draft Supplemental Environmental Impact Statement (DSEIS) to the organizations and individuals listed as follows. NRC will provide copies to other interested organizations and individuals upon request.

10.1 Federal Agency Officials

James Bashor
Bureau of Land Management
Newcastle Field Office
Newcastle, WY

John Keck
National Park Service
Devils Tower National Monument
Devils Tower, WY

Dr. John T Eddins
Advisory Council on Historic Preservation
Washington, D.C.

10.2 Tribal Government Officials

Donnie Cabniss
Apache Tribe
Tribal Historic Preservation Office
Anadarko, OK

John Murray
Blackfeet Tribe
Tribal Historic Preservation Office
Browning, MT

Lynette Gray
Cheyenne and Arapaho Tribes
Tribal Historic Preservation Office
Concho, OK

Steve Vance
Cheyenne River Sioux Tribe
Tribal Historic Preservation Office
Eagle Butte, SD

Alvin Windy Boy, Sr.
Chippewa Cree Tribe
Tribal Historic Preservation Office
Box Elder, MT

Ira Matt
Confederated Salish & Kootenai Tribe
Tribal Historic Preservation Office
Pablo, MT

Emerson Bull Chief
Crow Tribe
Tribal Historic Preservation Office
Crow Agency, MT

Wanda Wells
Crow Creek Sioux Tribe
Tribal Historic Preservation Office
Ft. Thompson, SD

Wilfred Ferris
Eastern Shoshone Tribe
Tribal Historic Preservation Office
Fort Washakie, WY

James B. Weston
Flandreau-Santee Sioux Tribe
Tribal Historic Preservation Office
Flandreau, SD

Morris E. Belgard
Fort Belknap Tribe
Tribal Historic Preservation Office
Harlem, MT

Darrell “Curley” Youpee
Fort Peck Tribes
Tribal Historic Preservation Office
Poplar, MT

Amie Tah-bone
Kiowa Indian Tribe of Oklahoma
NAGPRA Representative
Carnegie, OK

Clair S. Green
Lower Brule Sioux Tribe
Cultural Resources
Lower Brule, SD

Darlene Conrad
Tribal Historic Preservation Office
Northern Arapaho Tribe
Fort Washakie, WY

Conrad Fisher
Northern Cheyenne Tribe
Tribal Historic Preservation Office
Lame Deer, MT

Richard Iron Cloud
Oglala Sioux Tribe
Tribal Historic Preservation Office
Pine Ridge, SD

Russell Eagle Bear
Rosebud Sioux Tribe
Tribal Historic Preservation Office
Rosebud, SD

Rick Thomas
Santee Sioux Tribe of Nebraska
Tribal Historic Preservation Office
Niobrara, NE

Dianne Desrosiers
Sisseton-Wahpeton Oyate
Tribal Historic Preservation Office
Sisseton, SD

Darrell Smith
Spirit Lake Tribe
Tribal Historic Preservation Office
Fort Totten, ND

Wašté Wiŋ Young
Standing Rock Sioux Tribe
Tribal Historic Preservation Office
Fort Yates, ND

Elgin Crows Breast
Mandan, Hidatsa & Arikara Nation
Three Affiliated Tribes
Tribal Historic Preservation Office
New Town, ND

Bruce F. Nadeau
Turtle Mountain Band of Chippewa
Tribal Historic Preservation Office
Belcourt, ND

Lana Gravatt
Yankton Sioux Tribe
Tribal Historic Preservation Office
Wagner, SD

10.3 State Agency Officials

Mary Hopkins
Wyoming State Historic Preservation Office
Cheyenne, WY

Mark Rogaczewski
Wyoming Department of Environmental Quality
Land Quality Division

Tanner Shatto
Wyoming Department of Environmental Quality
Air Quality Division

John Passehl
Wyoming Department of Environmental Quality
Water Quality Division

Scott Talbott
Wyoming Game and Fish Department
Sheridan, WY

10.4 Local Agency Officials

Crook County Commissioners
Sundance, WY

10.5 Other Organizations and Individuals

Shannon Anderson, Esq.
Powder River Basin Resource Council
Sheridan, WY

Geoffrey H. Fettus, Esq.
Natural Resources Defense Council
Washington, DC

Ralph Knode
Strata Energy, Inc,
Gillette, WY

Anthony Thompson, Esq.
Thompson & Pugsley, PLLC
Washington, DC

Echo Bohl
Crook County Library Hulett Branch
Hulett, WY

Pamela Jespersen
Crook County Library Moorcroft Branch
Moorcroft, WY

APPENDIX A
CONSULTATION CORRESPONDENCE

CONSULTATION CORRESPONDENCE

The Endangered Species Act of 1973, as amended, and the National Historic Preservation Act of 1966, as amended, require that Federal agencies consult with applicable State and Federal agencies and groups prior to taking action that may affect threatened and endangered species, essential fish habitat, or historical and archaeological resources. This appendix lists consultation documentation related to these federal acts.

Table A.1
Chronology of Consultation Correspondence

Author	Recipient	Date of Letter	ADAMS Accession Number
U.S. Nuclear Regulatory Commission (L. Camper)	Fort Peck Tribal Executive Board	November 19, 2010*	ML103160580
U.S. Nuclear Regulatory Commission (L. Camper)	Fort Belknap Community Council	February 9, 2011**	ML110400321
Turtle Mountain Band of Chippewa Indians (K. Ferris)	U.S. Nuclear Regulatory Commission (A. Bjornsen)	April 14, 2011	ML111080059
U.S. Nuclear Regulatory Commission (K. Hsueh)	Sisseton-Wahpeton Lakota THPO (D. Desrosiers)	August 11, 2011***	ML112220386
U.S. Nuclear Regulatory Commission (K. Hsueh)	U.S. Department of the Interior, Fish and Wildlife Service (M. Sattelberg)	August 12, 2011	ML112200151
Apache Tribe of Oklahoma (L. Guy)	U.S. Nuclear Regulatory Commission (A. Bjornsen)	August 19, 2011	ML11336A224
U.S. Nuclear Regulatory Commission (A. Persinko)	Wyoming State Historic Preservation Office (M. Hopkins)	August 19, 2011	ML112150393
U.S. Nuclear Regulatory Commission (A. Persinko)	Advisory Council on Historic Preservation (J. Fowler)	August 19, 2011	ML112150427

Table A.1 Chronology of Consultation Correspondence (Cont.)			
Author	**Recipient**	**Date of Letter**	**ADAMS Accession Number**
U.S. Department of the Interior, Fish and Wildlife Service (M. Sattelberg)	U.S. Nuclear Regulatory Commission (K. Hsueh)	September 13, 2011	ML112770035
Advisory Council on Historic Preservation (C. Hall)	U.S. Nuclear Regulatory Commission (A. Persinko)	September 13, 2011	ML112770035
Wyoming Game and Fish Department (J. Emmerich)	U.S. Nuclear Regulatory Commission (A. Bjornsen)	September 22, 2011	ML112660130
U.S. Nuclear Regulatory Commission (L. Camper)	National Park Service, Devils Tower National Monument (D. FireCloud)	December 5, 2011	ML113120356
U.S. Nuclear Regulatory Commission (K. Hsueh)	Strata Energy, Inc. (M. James)	December 6, 2011	ML113200121
Advisory Council on Historic Preservation (C. Vaughn)	U.S. Nuclear Regulatory Commission (A. Persinko)	December 12, 2011	ML113480465
U.S. Nuclear Regulatory Commission (K. Hsueh)	Fort Peck Tribe (D. Youpee)	December 22, 2011***	ML113420504
Strata Energy, Inc. (M. James)	U.S. Nuclear Regulatory Commission (K. Hsueh)	January 12, 2012	ML120720266
U.S. Nuclear Regulatory Commission (K. Hsueh)	Advisory Council on Historic Preservation (C. Vaughn)	January 31, 2012	ML113490371
Rosebud Sioux Tribe (R. Eagle Bear)	U.S. Nuclear Regulatory Commission (A. Bjornsen)	February 1, 2012	ML120390551

Table A.1 Chronology of Consultation Correspondence (Cont.)			
Author	**Recipient**	**Date of Letter**	**ADAMS Accession Number**
Strata Energy, Inc. (R. Knode)	U.S. Nuclear Regulatory Commission (K. Hsueh)	August 31, 2012	ML12248A421
U.S. Nuclear Regulatory Commission (K. Hsueh)	Santee Sioux Tribe of Nebraska (R. Thomas)	September 20, 2012***	ML12264A220
WWC Engineering (B. Schiffer)	U.S. Nuclear Regulatory Commission (J. Moore)	October 16, 2012	ML12311A338
U.S. Nuclear Regulatory Commission (K. Hsueh)	Kiowa Indian Tribe (J. Eskew)	November 21, 2012***	ML12325A776

*Similar letters sent to Cheyenne River Sioux Tribe (J. Plenty), Crow Creek Sioux Tribe (L. Thompson, Jr.), Lower Brule Sioux Tribal Council (M. Jandreau), Oglala Sioux Tribal Council (T. Two Bulls), Rosebud Sioux Tribal Council (R. Bordeaux), Santee Sioux Nation (R. Trudell), Standing Rock Sioux Tribe (R. Thunder), Three Affiliated Tribes Business Council (M. Wells), Northern Cheyenne Tribe (L. Spaug), Cheyenne and Arapaho Tribes (D. Flyingman), Arapaho Business Committee (H. Spoonhunter), Crow Tribal Council (C. Eagle), and Eastern Shoshone Tribe (I. Posey).

**Similar letters sent to Standing Rock Lakota Tribal Council (C. Murphy), Crow Tribal Council (C. Eagle), Apache Tribe of Oklahoma (H. Kostzuta), Sisseton-Wahpeton Lakota (A. Grey, Sr.), Yankton Lakota Tribe (R. Courneyor), Blackfeet Tribal Business Council (W. Sharp), Crow Creek Sioux Tribal Council (B. Sazue), Lower Brule Sioux Tribal Council (M. Jandreau), Spirit lake Tribal Council (M. Pearson), Oglala Lakota Tribal Council (T. TwoBulls), Shoshone Business Council (I. Posey), Northern Cheyenne Tribal Council (G. Small), Rosebud Sioux Tribal Council (R. Bordeaux), Fort Peck Tribal Executive Board (A. Stafne), Cheyenne and Arapahoe Tribes of Oklahoma (J. Boswell),Turtle Mountain Chippewa Tribal Council (R. Marcellias), Santee Sioux Nation (R. Trudell), Arapaho Business Council (H. Spoonhunter), Three Affiliated Tribes Business Council (M. Levings), Kiowa Indian Tribe of Oklahoma (D. Tofpi), Flandreau Santee Lakota Executive Committee (G. Bouland), Confederated Salish & Kootenai (E. Moran), and Cheyenne River Lakota Tribal Council (J. Plenty).

***Similar letters sent to the Tribal Historic Preservation Officers: Fort Peck Tribal Executive Board (D. Youpee), Fort Belknap Community Council (D. Belgard), Standing Rock Lakota Tribal Council (W. Young), Crow Tribal Council (D. Old Horn), Yankton Lakota Tribe (L. Gravatt), Blackfeet Tribal Business Council (J. Murray), Crow Creek Sioux Tribal Council (W. Wells), Lower Brule Sioux Tribal Council (C. Green), Spirit lake Tribal Council (A. Shaw), Oglala Lakota Tribal Council (W. Mesteth), Shoshone Business Council (W. Ferris), Northern Cheyenne Tribal Council (C. Fisher), Rosebud Sioux Tribal Council (R. Eagle Bear), Cheyenne and Arapahoe Tribes of Oklahoma (D. Hamilton and), Santee Sioux Nation (L. Ickes), Arapaho Business Council (D. Conrad), Three Affiliated Tribes Business Council (E. Crows Breast), Kiowa Indian Tribe of Oklahoma (J. Eskew), Flandreau Santee Lakota Executive Committee (J. Weston), Confederated Salish & Kootenai (C. Burke), and Cheyenne River Lakota Tribal Council (S. Vance), Sisseton-Wahpeton Lakots (D. Desrosiers).

APPENDIX B
VISUAL IMPACTS ANALYSIS

APPENDIX B: VISUAL IMPACT ANALYSIS

Scenic Quality Inventory Point B-1

Photograph from Scenic Quality Inventory Point C-1 to North

Table B.1
Scenic Quality Inventory and Evaluation

Key Factor	Rating Criteria	Score
Landform	Low rolling hills, foothills, or flat valley bottoms or few or no interesting landscape features.	1
Vegetation	Some variety of vegetation, but only one or two major types.	3
Water	Present/Little Missouri River and the Oshoto Reservoir are occasionally visible.	1
Color	Some intensity or variety in colors and contrast of the soil, rock, and vegetation, but not a dominant scenic element.	3
Influence of Adjacent Scenery	Adjacent scenery has little or no influence on overall visual quality.	0
Scarcity	Interesting within its setting, but fairly common within the region.	1
Cultural Modifications	Modifications add variety, but are very discordant and promote strong disharmony.	-2
	TOTAL SCORE	**7**

Scenic Quality Inventory Point B-2

Photograph from Scenic Quality Inventory Point B-2 to East

Table B.2 Scenic Quality Inventory and Evaluation		
Key Factor	**Rating Criteria**	**Score**
Landform	High vertical relief as expressed in prominent cliffs, spires, or massive rock outcrops, or severe surface variation or highly eroded formations including major badlands or dune systems; or detail features dominant and exceptionally striking and intriguing such as glaciers.	5
Vegetation	A variety of vegetative types as expressed in interesting forms, textures, and patterns.	5
Water	Present, but not noticeable.	0
Color	Some intensity or variety in colors and contrast of the soil, rock, and vegetation, but not a dominant scenic element.	3
Influence of Adjacent Scenery	Adjacent scenery greatly enhances visual quality (Devils Tower).	5
Scarcity	One of a kind, or unusually memorable, or very rare within region. Consistent chance for exceptional wildlife or wildflower viewing.	5
Cultural Modifications	Modifications add little or no visual variety to the area, and introduce no discordant elements.	0
	TOTAL SCORE	**23**

Scenic Quality Inventory Point B-3

Photograph from Scenic Quality Inventory Point B-3 to South

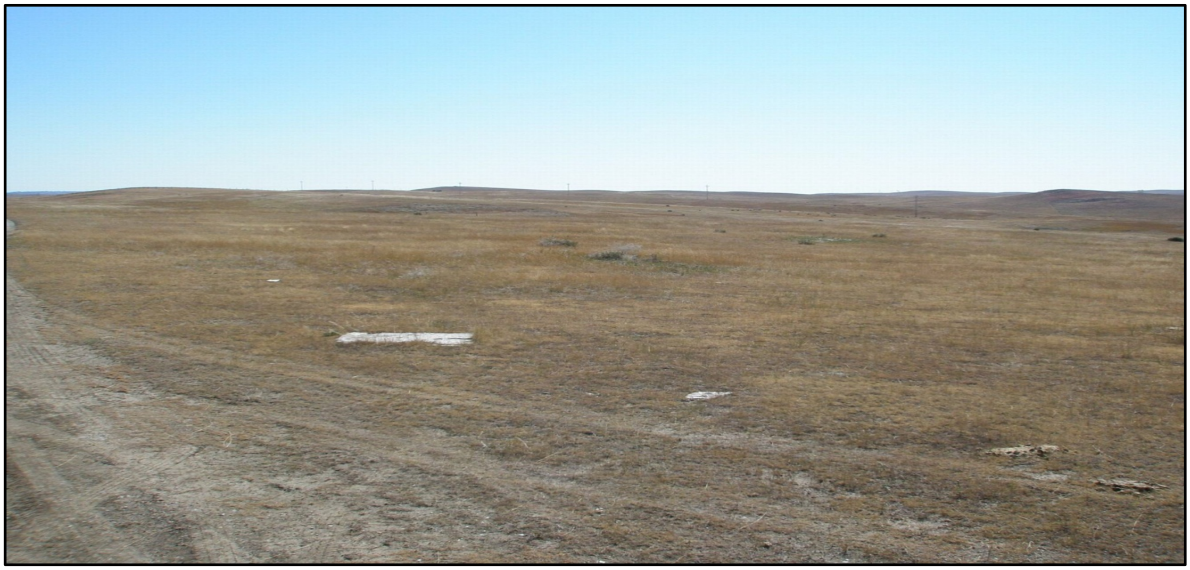

Table B.3 Scenic Quality Inventory and Evaluation		
Key Factor	**Rating Criteria**	**Score**
Landform	Low rolling hills, foothills, or flat valley bottoms; or few or no interesting landscape features.	1
Vegetation	Little or no variety or contrast in vegetation.	1
Water	Present, but not noticeable.	0
Color	Subtle color variations, contrast, or interest; generally mute tones.	1
Influence of Adjacent Scenery	Adjacent scenery has little or no influence on overall visual quality.	0
Scarcity	Interesting within its setting, but fairly common within the region.	1
Cultural Modifications	Modifications add little or no visual variety to the area and introduce no discordant elements.	0
	TOTAL SCORE	**4**

Scenic Quality Inventory Point B-4

Photograph from Scenic Quality Inventory Point B-4 to South

Table B.4 Scenic Quality Inventory and Evaluation		
Key Factor	**Rating Criteria**	**Score**
Landform	Low rolling hills, foothills, or flat valley bottoms; or few or no interesting landscape features.	1
Vegetation	Some variety of vegetation, but only one or two major types.	3
Water	Present, but not noticeable.	1
Color	Some intensity or variety in colors and contrast of the soil, rock and vegetation, but not a dominant scenic element.	3
Influence of Adjacent Scenery	Adjacent scenery has little or no influence on overall visual quality.	0
Scarcity	Interesting within its setting, but fairly common within the region.	1
Cultural Modifications	Modifications add variety but are discordant and promote disharmony.	-1
	TOTAL SCORE	**8**

Table B.5
Scenic Quality Inventory and Evaluation
Average of Four Views

Key Factor	Score
Landform	2.00
Vegetation	3.00
Water	0.50
Color	2.50
Influence of Adjacent Scenery	1.25
Scarcity	2.00
Cultural Modifications	-0.75
AVERAGE	**10.50**

NRC FORM 335
(12-2010)
NRCMD 3.7

U.S. NUCLEAR REGULATORY COMMISSION

BIBLIOGRAPHIC DATA SHEET

(See instructions on the reverse)

1. REPORT NUMBER
(Assigned by NRC, Add Vol., Supp., Rev., and Addendum Numbers, if any.)

NUREG-1910, Supplement 5
Draft

2. TITLE AND SUBTITLE

Environmental Impact Statement for the Ross ISR Project in Crook County, Wyoming: Supplement to the Generic Environmental Impact Statement for In-Situ Leach Uranium Milling Facilities (Draft For Comment)

3. DATE REPORT PUBLISHED

MONTH	YEAR
March	2013

4. FIN OR GRANT NUMBER

5. AUTHOR(S)

6. TYPE OF REPORT

Technical

7. PERIOD COVERED (Inclusive Dates)

8. PERFORMING ORGANIZATION - NAME AND ADDRESS (If NRC, provide Division, Office or Region, U. S. Nuclear Regulatory Commission, and mailing address; if contractor, provide name and mailing address.)

Division of Waste Management and Environmental Protection
Office of Federal and State Materials and Environmental Management Programs
U.S. Nuclear Regulatory Commission
Washington, DC 20555-001

9. SPONSORING ORGANIZATION - NAME AND ADDRESS (If NRC, type "Same as above", if contractor, provide NRC Division, Office or Region, U. S. Nuclear Regulatory Commission, and mailing address.)

Same as above

10. SUPPLEMENTARY NOTES

11. ABSTRACT (200 words or less)

By a letter dated January 4, 2011, Strata Energy, Inc. (Strata or the "Applicant") submitted a license application to the Nuclear Regulatory Commission (NRC) for a new source and byproduct materials license for the proposed Ross Project. The Ross Project would be located in Crook County, Wyoming, which is in the Nebraska-South Dakota-Wyoming Uranium Milling Region identified in the NUREG-1910, Generic Environmental Impact Statement (GEIS) for In-Situ Leach Uranium Milling Facilities. The NRC staff prepared this Supplemental Environmental Impact Statement (SEIS) to evaluate the potential environmental impacts of the Applicant's proposal to construct, operate, conduct aquifer restoration, and decommission an in situ uranium-recovery facility at the Ross Project. This SEIS describes the environment that could be affected by the proposed Ross Project activities, estimates the potential environmental impacts resulting from the Proposed Action and two Alternatives, discusses the corresponding proposed mitigation measures, and describes the Applicant's environmental-monitoring program. The NRC staff evaluated site-specific data and information to determine whether the site characteristics and the Applicant's proposed activities were consistent with those evaluated in the GEIS. The NRC staff will respond to public comments received on the draft SEIS in the final SEIS.

12. KEY WORDS/DESCRIPTORS (List words or phrases that will assist researchers in locating the report.)

Uranium Recovery
In-Situ Recovery Process
Uranium
Environmental Impact Statement
Supplemental Environmental Impact Statement

13. AVAILABILITY STATEMENT

unlimited

14. SECURITY CLASSIFICATION

(This Page)
unclassified

(This Report)
unclassified

15. NUMBER OF PAGES

16. PRICE

UNITED STATES
NUCLEAR REGULATORY COMMISSION
WASHINGTON, DC 20555-0001

OFFICIAL BUSINESS

NUREG-1910
Supplement 5
Draft

Environmental Impact Statement for the Ross ISR Project
in Crook County, Wyoming

March 2013